Installation Manual

Generator Set

Cummins NPower GF Series

English Version 03/2014 Doc 17855

NPower

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Cummins NPower LLC Generator Sets
Limited Warranty

Commercial Generating Set

This limited warranty applies to all Cummins NPower LLC (hereinafter referred to as “Cummins NPower” branded commercial generating sets and associated accessories (hereinafter referred to as "Product"). This warranty covers any failures of the Product, under normal use and service, which result from a defect in material or factory workmanship.

Warranty Period:

The warranty start date for stationary Product is the date of initial start up, demonstration or 18 months after factory ship date, whichever is sooner. The warranty start date for rental or oil and gas products is the date of receipt of Product by the end customer. See table for details.

Base Warranty Duration
(Whichever occurs first)

Rating	Months	Maximum Hours
Emergency Standby Power (ESP)	**12**	**500**
Prime Power (PRP)	**12**	**Unlimited**

Emergency Standby Power (ESP) is defined as the maximum power available during a variable electrical power sequence, under the stated operating conditions, for which a generating set is capable of delivering in the event of a reliable utility power outage. The permissible average power output over 24 hours of operation shall not exceed 70% of the ESP. For applications supporting an unreliable utility service, the Prime Power (PRP) rating should be used.
Prime Power (PRP) is defined as being the maximum power which a generating set is capable of delivering continuously while supplying a variable electrical load. The permissible average power output over 24 hours of operation shall not exceed 70% of the PRP.

Cummins NPower Responsibilities:

In the event of a failure of the Product during the warranty period due to defects in material or workmanship, Cummins NPower will only be responsible for the following costs:

- All parts and labor required to repair the Product.
- Reasonable travel expenses to and from the Product site location.
- Maintenance items that are contaminated or damaged by a warrantable failure.

Owner Responsibilities:

The owner will be responsible for the following:

- Notifying Cummins NPower distributor or dealer within 30 days of the discovery of failure.
- Installing, operating, commissioning and maintaining the Product in accordance with Cummins NPower’s published policies and guidelines.
- Providing evidence for date of commissioning.
- Providing sufficient access to and reasonable ability to remove the Product from the installation in the event of a warrantable failure.

In addition, the owner will be responsible for:

- Incremental costs and expenses associated with Product removal and reinstallation resulting from difficult or non-standard installations.
- Costs associated with rental of generating sets used to replace the Product being repaired.
- Costs associated with labor overtime and premium shipping requested by the owner.
- All downtime expenses, fines, all applicable taxes, and other losses resulting from a warrantable failure.

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Limitations:

This limited warranty does not cover Product failures resulting from:

- Inappropriate use relative to designated power rating or application guidelines.
- Normal wear and tear, negligence, accidents or misuse.
- Improper and/or unauthorized installation.
- Lack of maintenance or unauthorized repair.
- Noncompliance with any Cummins NPower published guideline or policy.
- Use of improper or contaminated fuels, coolants or lubricants.
- Improper storage before and after commissioning.
- Owner's delay in making Product available after notification of potential Product problem.
- Replacement parts and accessories not authorized by Cummins NPower.
- Use of Battle Short Mode.
- Owner or operator abuse or neglect such as: operation without adequate coolant or lubricants; over-fueling; over-speeding; lack of maintenance to lubricating, cooling or air intake systems; late servicing and maintenance; improper storage, starting, warm-up, run-in or shutdown practices, or for progressive damage resulting from a defective shutdown or warning device.
- Damage to parts, fixtures, housings, attachments and accessory items that are not part of the generating set.

This limited warranty does not apply to:

- Costs of maintenance, adjustments, installation, commissioning or start-up.
- Starting batteries, heating elements, trailers and enclosures.
- Components added to the Product after shipment from Cummins NPower.

Please contact your local Cummins NPower Distributor for clarification concerning these limitations.

Extended Warranty

Cummins NPower offers the Cummins ENCOMPASS Extended Coverage program for parts and labor as listed in Cummins Bulletin # 3624424 for a period of 5 years or 2000 hours.

Cummins NPower Right to Failed Components:

Failed components claimed under warranty remain the property of Cummins NPower. Cummins NPower has the right to reclaim any failed component that has been replaced under warranty.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS NPOWER IN REGARD TO THE PRODUCT. CUMMINS NPOWER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT IS CUMMINS NPOWER LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

This limited warranty shall be enforced to the maximum extent permitted by applicable law. This limited warranty gives the owner specific rights that may vary from state to state or from jurisdiction to jurisdiction.

Table of Contents

Warranty Information

Section 1 - Safety

1.1 Advisory and Cautionary Statements 1-1
1.2 Safety/Data Labels 1-3

Section 2 - Introduction

2.1 About This Manual. 2-1
2.2 Installation Overview 2-1
2.3 Application and Installation 2-1
2.4 Safety Considerations 2-1
2.5 Standby Heating Devices 2-2
2.6 Product Modifications 2-2

Section 3 - Installation

3.1 Mounting the Generator Set 3-1
3.1.1 Location 3-1
3.1.2 Mounting 3-1
3.1.3 Access To Set 3-1
3.1.4 Mechanical Connections 3-2
3.1.5 Base Drains (Optional). 3-2
3.2 Fuel System. 3-2
3.2.1 Fuel Lines - Routing. 3-2
3.2.2 Natural Gas/Propane Vapor/Propane Liquid Fuel System (Dual Fuel System). 3-2
3.2.3 Fuel Supply Pressure. 3-3
3.2.4 Check Gas Leaks and Correct. 3-3
3.2.5 Fuel Heater (Optional-MOH models only) 3-3
3.2.6 Regulator (Optional). 3-3
3.2.7 Fuel Filters (Optional-MOH models only). 3-3
3.3 Battery Selection 3-3
3.3.1 Battery Requirements 3-3
3.3.2 Battery Installation 3-4
3.4 Exhaust System. 3-4
3.5 Installation of Sensors 3-5
3.6 Air Fuel Ratio (AFR) Controller 3-6
3.7 Catalyst-Removable Elements (Only available on some models). 3-6
3.8 Engine 3-Way Catalyst (Model Specific) 3-6
3.8.1 Installation and Applications Guidelines 3-6
3.8.2 Owner's Responsibilities 3-7
3.8.3 Preparation 3-8
3.8.4 3-Way Catalyst Installation 3-9
3.9 Air Fuel Setting and Emission Measurement 3-10
3.10 Ventilation and Cooling 3-10
3.11 Vents and Ducts 3-10
3.12 Oil Reservoir (Optional). 3-10
3.13 Dampers 3-10

Table of Contents

3.14 Radiator Set Cooling Requirements 3-10
3.15 Remote Radiator Cooling Requirements (Available on All Models) 3-11

Section 4 - Controls

4.1 Control System Overview 4-1
4.2 Control Wiring Installation 4-1
4.3 Remote Monitor/Control Connections (PCC) 4-1
4.4 Control Relays (Optional) 4-3
4.5 AC Electrical Connections 4-3
4.6 AC Wiring 4-4
4.6.1 Generator Voltage Connections 4-4
4.6.2 Load Connections 4-5
4.6.3 Load Balancing 4-5
4.6.4 Current Transformers 4-5
4.7 Coolant Heater (Optional) 4-6
4.7.1 Battery Heater (Optional) 4-6
4.7.2 Control Heater (Optional) 4-6
4.7.3 Breather Heater (Optional) 4-7

Section 5 - Pre-Start Preparation

5.1 Electrical System 5-1
5.2 Battery Connections 5-1
5.3 InPower Service Tool General Information (PCC) 5-1
5.4 PCC Options Pre-Start Checks 5-1
5.5 Start Up Procedure 5-1
5.6 Emissions Requirements 5-2
5.7 Fuel Pressure and Mixture Adjustments 5-2
5.7.1 Fuel Supply Pressure 5-2
5.7.2 Fuel System Components 5-3
5.7.3 Fuel System Operation 5-3
5.7.4 Fuel Mixture Adjustments 5-4
5.7.4.1 Electronic Engines 5-4
5.7.4.2 Non-Electronic Engines 5-4

Section 6 - Installation Checklist

6.1 General 6-1
6.2 Generator Set Support 6-1
6.3 Cooling Air Flow 6-1
6.4 Fuel System 6-1
6.5 Exhaust System 6-2
6.6 AC And DC Wiring 6-2
6.7 Generator Set Pre-Start 6-2

Section 7 - Wiring Diagrams

7.1 General 7-1
Wiring Diagrams - Electronic Engines 7-1
Wiring Diagrams - Hydro-Mechanical Engines 7-1

Table of Contents

Section 1 - Safety

IMPORTANT SAFETY INSTRUCTIONS - This manual contains important instructions that should be followed during installation and maintenance of the generator and batteries. SAVE THESE INSTRUCTIONS.

Before operating the generator set (genset), read the Operator's Manual and become familiar with it and the equipment. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

1.1 Advisory and Cautionary Statements

Advisory and Cautionary Statements are used throughout this manual to call attention to special information, correct operating procedures, and safety precautions.

NOTE: *A general advisory statement relating to equipment operation and maintenance procedures.*

IMPORTANT: *A specific advisory statement intended to prevent damage to the equipment or associated components.*

Cautionary Statements consist of three levels:

DANGER

This symbol warns of immediate hazards which will result in severe personal injury or death.

WARNING

This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.

CAUTION

This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.

CAUTION

Fuel And Fumes Are Flammable.

Fire, explosion, and personal injury or death can result from improper practices.

- DO NOT fill fuel tanks while the engine is running unless the tanks are outside the engine compartment. Fuel contact with the hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. The fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.
- Natural gas is lighter than air, and will tend to gather under hoods. Propane is heavier than air, and will tend to gather in sumps or low areas. NFPA code requires all persons handling propane to be trained and qualified.
- Be sure all fuel supplies have a positive shut-off valve.
- Be sure the battery area has been well-ventilated prior to servicing near it. Lead-acid batteries emit a highly explosive hydrogen gas that can be ignited by arcing, sparking, smoking, etc.

WARNING

Exhaust Gases Are Deadly.The engine exhaust from this product contains chemicals known to the State of California and some of its constituents cause cancer, birth defects, or other reproductive harm.

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Make sure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.

- Be sure the unit is well ventilated.

WARNING

Moving Parts Can Cause Severe Personal Injury or Death.

- Keep your hands, clothing, and jewelry away from moving parts.

- Before starting work on the generator set, disconnect the battery charger from its AC source, then disconnect the starting batteries, negative (-) cable first. This will prevent accidental starting.

- Make sure that fasteners on the generator set are secure. Tighten supports and clamps. Keep guards in position over fans, drive belts, etc.

- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.

- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

WARNING

Electrical Shock Can Cause Severe Personal Injury or Death.

- Disconnect electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.

- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.

- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag and lock open switches to avoid accidental closure.

- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

General Safety Precautions

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.

- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.

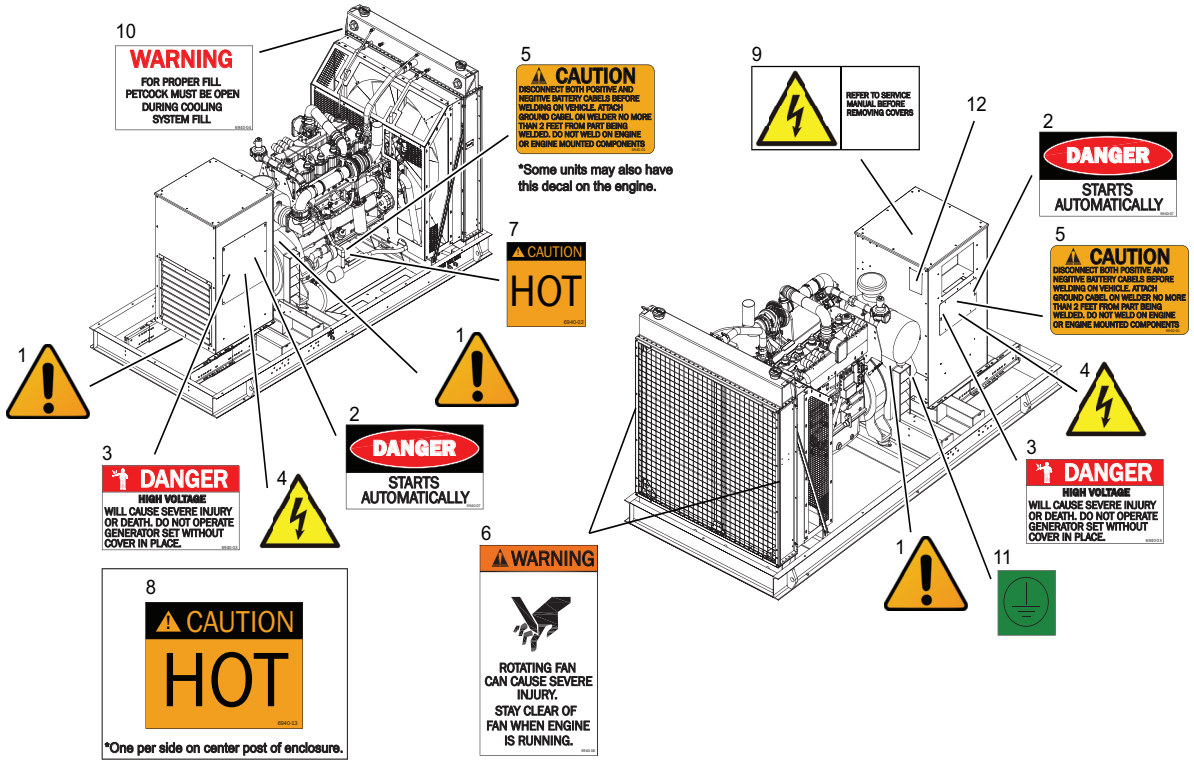
- Keep multi-class ABC fire extinguishers handy. Class A fires involve ordinary combustible materials such as wood and cloth; Class B fires involve combustible and flammable liquid fuels and gaseous fuels; Class C fires involve live electrical equipment. (Ref. NFPA No. 10).

- Make sure that rags are not left on or near the engine.

- Make sure the generator set is mounted in a manner to prevent combustible materials from accumulating under the unit.

- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.
- Substances in exhaust gases have been identified by some state or federal agencies as causing cancer or reproductive toxicity. Take care not to breath or ingest or come into contact with exhaust gases.
- Do not store any flammable liquids, such as fuel, cleaners, oil, etc., near the generator set. A fire or explosion could result.
- Wear hearing protection when going near an operating generator set.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, turbo charger, and exhaust system.

1.2 Safety/Data Labels


10
WARNING
FOR PROPER FILL PETCOCK MUST BE OPEN DURING COOLING SYSTEM FILL
5
CAUTION
DISCONNECT BOTH POSITIVE AND NEGITIVE BATTERY CABELS BEFORE WELDING ON VEHICLE. ATTACH GROUND CABEL ON WELDER NO MORE THAN 2 FEET FROM PART BEING WELDED. DO NOT WELD ON ENGINE OR ENGINE MOUNTED COMPONENTS
*Some units may also have this decal on the engine.
7
CAUTION
HOT
1
1
2
DANGER
STARTS AUTOMATICALLY
3
DANGER
HIGH VOLTAGE
WILL CAUSE SEVERE INJURY OR DEATH. DO NOT OPERATE GENERATOR SET WITHOUT COVER IN PLACE.
4
8
CAUTION
HOT
*One per side on center post of enclosure.
6
WARNING
ROTATING FAN CAN CAUSE SEVERE INJURY.
STAY CLEAR OF FAN WHEN ENGINE IS RUNNING.
9
REFER TO SERVICE MANUAL BEFORE REMOVING COVERS
12
2
DANGER
STARTS AUTOMATICALLY
5
CAUTION
DISCONNECT BOTH POSITIVE AND NEGITIVE BATTERY CABELS BEFORE WELDING ON VEHICLE. ATTACH GROUND CABEL ON WELDER NO MORE THAN 2 FEET FROM PART BEING WELDED. DO NOT WELD ON ENGINE OR ENGINE MOUNTED COMPONENTS
4
3
DANGER
HIGH VOLTAGE
WILL CAUSE SEVERE INJURY OR DEATH. DO NOT OPERATE GENERATOR SET WITHOUT COVER IN PLACE.
1
11

1. Decal, Caution
2. Decal, Danger Auto Start (P/N 6940-07)
3. Decal, Danger High Voltage (P/N 6940-03)
4. Decal, Caution Shock Hazard
5. Decal, Caution Welding (P/N 6940-01)
6. Decal, Warning Rotating Fan (P/N 6940-06)
7. Decal, Caution Hot, Sm (P/N 6940-02)
8. Decal, Caution Hot, Lg (P/N 6940-13) (Enclosed Units Only)
9. Decal, Caution Cover
10. Decal, Warning Petcock (P/N 6940-04) (KTA19 Only)
11. Decal, Ground
12. Data Tag, Genset (P/N 24588)

Figure 1-1 Generator Decal Locations (typical)

KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE

Section 2 - Introduction

2.1 About This Manual

This manual provides installation instructions for the generator set models listed on the front cover. This includes the following information:

Mounting Recommendations - for fastening the generator set to the base and space requirements for normal operation and service.

Mechanical and Electrical Connections - covers most aspects of the generator set installation. Pre-start - checklist of items or procedures needed to prepare generator set for operation.

Initial Startup - tests the complete system to ensure proper installation, satisfactory performance, and safe operation. Refer to Operator Manual for troubleshooting information.

Installation Checklist - reference checks upon completion of installation.

This manual DOES NOT provide application information for selecting a generator set or designing the complete installation. If it is necessary to design the various integrated systems (fuel, exhaust, cooling, etc.), additional information is required. Review standard installation practices. For engineering data specific to the generator set, refer to the Specification and Data Sheets. For application information, refer to Cummins Application Manual T-030, Liquid Cooled Generator Sets.

2.2 Installation Overview

These installation recommendations apply to typical installations with standard model generator sets. Whenever possible, these recommendations also cover factory designed options or modifications. However, because of the many variables in any installation, it is not possible to provide specific recommendations for every situation. If there are any questions not answered by this manual, contact your nearest Cummins distributor for assistance.

2.3 Application and Installation

A power generation system must be carefully planned and correctly installed for proper operation. This involves two essential elements: application and installation.

Application (as it applies to generator set installations) refers to the design of the complete power generation system that usually includes power distribution equipment, transfer switches, ventilation equipment, mounting pads, and cooling, exhaust, and fuel systems. Each component must be correctly designed so the complete system will function as intended. Application and design is an engineering function generally done by specifying engineers or other trained specialists. Specifying engineers or other trained specialists are responsible for the design of the complete standby system and for selecting the materials and products required.

Installation refers to the actual set-up and assembly of the power generation system. The installers set up and connect the various components of the system as specified in the system design plan. The complexity of the system normally requires the special skills of qualified electricians, plumbers, sheet metal workers, etc. to complete the various segments of the installation. This is necessary so all components are assembled using standard methods and practices.

2.4 Safety Considerations

The generator set has been carefully designed to provide safe and efficient service when properly installed, maintained, and operated. However, the overall safety and reliability of the complete system is dependent on many factors outside the control of the generator set manufacturer. To avoid possible safety hazards, make all mechanical and electrical connections to the generator set exactly as specified in this manual. All systems external to the generator (fuel, exhaust, electrical, etc.) must comply with all applicable codes. Make certain all required inspections and tests have been completed and all code requirements have been satisfied before certifying the installation is complete and ready for service.

2.5 Standby Heating Devices

In accordance with NFPA 110, Cummins NPower recommends installing generator sets (life safety systems) equipped with engine jacket water coolant heaters in locations where the minimum ambient temperature is below 4°C (40°F). NFPA also requires that the engine jacket water coolant be maintained at a minimum of 32°C (90°F) and, for most applications, accept the emergency load in 10 seconds or less.

The Engine Cold (Code 1435) message, in conjunction with illumination of the warning light is provided to meet the requirements of NFPA 110. The engine cold sensing logic initiates a warning when the engine jacket water coolant temperature falls below 21°C (70°F). In applications where the ambient temperature falls below 4°C (40°F), a cold engine may be indicated even though the coolant heaters are connected. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions may be necessary to warm the engine before applying a load.

2.6 Product Modifications

Agency certified products purchased from Cummins NPower comply only with those specific requirements and as noted on company product specification sheets. Subsequent modifications must meet commonly accepted engineering practices and/or local, state and national codes and standards. Product modifications must be submitted to the local authority having jurisdiction for approval.

The information, specifications, and recommended guidelines in this manual are based on information in effect at the time of printing. Cummnis Npower, LLC. and Cummins, Inc. reserves the right to make changes at any time without obligation. If you find differences between your engine and the information in this manual, contact your local Cummins Authorized Repair Location or call 1-800-DIESEL (1-800-343-7357) toll free in the U.S. and Canada.

2.7 Product Inquiries (Model 150 GFPA)

For Model 150 GFPA engine related inquires, contact a PSI representative at the service department technical support line at 1-888-331-5764 or e-mail service@powergreatlakes.com. For questions relating to the generator controls on this model, please contact Npower Service at 1-866-831-7620 or www.cumminsnpower.com for more information.

Section 3 - Installation

3.1 Mounting the Generator Set

Generator set installations must be engineered so the generator set will function properly under the expected load conditions. Use these instructions as a general guide only. Follow the instructions of the consulting engineer when locating or installing any components. The complete installation must comply with all local and state building codes, fire ordinances, and other applicable regulations. Consider these requirements before installation:

- Level mounting surface
- Adequate cooling air
- Adequate fresh induction air
- Discharge of generator set air
- Non-combustible mounting surface
- Discharge of exhaust gases
- Electrical connections
- Accessibility for operation and servicing
- Noise levels
- Vibration isolation

3.1.1 Location

Generator set location is decided mainly by related systems such as ventilation, wiring, fuel, and exhaust. The set should be located as near as possible to the main power service entrance. Exhaust must not be able to enter or accumulate around inhabited areas.

Provide a location away from extreme ambient temperatures and protect the generator set from adverse weather conditions. An optional housing is available for outside operation.

WARNING

Incorrect installation, service, or parts replacement, can result in severe personal injury, death, and/or equipment damage. Service personnel must be trained and experienced to perform electrical and mechanical component installation.

IMPORTANT: *Depending on location and intended use, federal, state, or local laws and regulation may require the customer to obtain an air quality emissions permit before beginning installation of the genset. Be sure to consult local pollution control or air quality authorities before completing construction plans.*

3.1.2 Mounting

Generator sets are mounted on a steel skid that provides proper support. The engine-generator assembly is isolated from the skid frame by rubber mounts that provide adequate vibration isolation for normal installations. Where required by building codes or special isolation needs, generator sets may be mounted on rubber pads or mechanical spring isolators. The use of unapproved isolators may result in harmful resonances and may void the genset warranty.

Mount the generator set on a substantial and level base such as a concrete pad. A non-combustible material must be used for the pad.

Use 16 mm or (5/8) inch anchored mounting bolts to secure the generator set skid to the floor to prevent movement.

3.1.3 Access To Set

Generally, at least 1 meter (3 ft) of clearance should be provided on all sides of the generator set for maintenance and service access. (Increase clearance by width of door if optional housing is used.) A raised foundation or slab of 150 mm (6 in) or more above floor level will make servicing easier.

Lighting should be adequate for operation, maintenance and service operations and should be connected on the load side of the transfer switch so that it is available at all times.

3.1.4 Mechanical Connections

The generator set mechanical system installation includes connecting the fuel, exhaust, ventilation and cooling systems. Before starting any type of fuel installation, all pertinent state and local codes must be complied with and the installation must be inspected before the unit is put in service.

IMPORTANT: *All pipe threaded fuel system fittings, including container fittings, must be assembled using a pipe joint sealing compound designed for use with natural gas or propane as applicable per industry standards.*

3.1.5 Base Drains (Optional)

Some units are equipped with drain extensions that allow for oil or coolant (or both) drains to be brought out to the base edge for convenient maintenance. These drains have an in-line ball valve or Fumoto valve installed for control. Factory drains require no further installation at site.

3.2 Fuel System

These gensets can be equipped to operate on:

- Natural gas
- Combination of natural gas and propane (Dual Fuel for select models)

In all fuel system installations, cleanliness is of the upmost importance. Make every effort to prevent entrance of moisture, dirt or contaminants of any kind. Clean all fuel system components before installing

3.2.1 Fuel Lines - Routing

A flexible fuel hose(s) or section of flexible fuel hose(s) must be used between the engine's fuel system and fuel supply line to protect the fuel system from damage caused by vibration, expansion and contraction. Genset fuel supply line must be dedicated supply line from utility.

CAUTION

Fuel leaks create fire and explosion hazards which can result in severe personal injury or death. Always use flexible tubing between engine and fuel supply to avoid line failure and leaks due to vibration. The fuel system must meet applicable codes.

Installation of the fuel hose must be done according to all applicable codes and standards, and installation recommendations provided by the manufacturer. The flexible hose used must be approved by the hose manufacture for use with the genset fuel type and product application.

Support fuel lines to restrain movement and prevent chaffing or contact with sharp edges, electrical wiring and hot exhaust parts.

CAUTION

Sparks and hot surfaces can ignite fuel, leading to severe personal injury or death. Do not route fuel lines near electrical wiring or hot exhaust parts.

Fuel lines must be routed and secured per local, state and national codes.

Install a dry-type fuel filter ahead of the service pressure regulator to protect the sensitive pressure regulating components and orifices downstream from rust, scale and other solid substances carried along in the gas stream.

3.2.2 Natural Gas/Propane Vapor/Propane Liquid Fuel System (Dual Fuel System)

WARNING

Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not smoke if you smell gas or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other sources of ignition well away from genset and areas sharing ventilation. Keep a type ABC fire extinguisher handy.

WARNING

NFPA No. 58 requires all persons handling and operating propane to be trained in proper handling and operating procedures.

Gaseous-fuel supply system design, materials, components, fabrication, assembly, installation, testing, inspection, operation and maintenance must comply with the applicable codes. See NFPA No. 37, No. 54, and No. 58.

Most codes require both manual and electric (battery-powered) shutoff valves ahead of the flexible fuel hose(s). The manual valve should be of the indicating

type. The electric valve should be wired so that the valve is closed when the genset is off.

The recommendations in Cummins Application Manual T-030 should be followed in regard to fuel supply system pipe sizes, manual shut-off valves, fuel filters, and gas pressure regulators.

3.2.3 Fuel Supply Pressure

WARNING

High gas supply pressure can cause gas leaks which can lead to fire and severe personal injury or death. Gas supply pressure must be adjusted to Specifications by qualified personnel.

For propane (vapor withdrawal) and natural gas, the maximum permissible fuel supply pressure is 5.0 kPa (20 in WC) and the recommended minimum is 3.7 kPa (15 in WC).

For propane (liquid withdrawal), the maximum permissible fuel supply pressure is 2,153 kPa (312 psi) under any operating condition.

WARNING

Gaseous fuel leaks into an inadequately ventilated space can lead to explosive accumulations of gas. Natural gas rises when released into the air and can accumulate under overhanging hoods and inside housings and buildings. Propane sinks when released into the air and can accumulate inside housings, basements and other below-grade spaces. Precautions must be taken to prevent gas leaks and the accumulation of gaseous fuel in the event of a leak.

3.2.4 Check Gas Leaks and Correct

All fuel-system connections, including the container with associated valves and fittings, must be tested for leaks with a soap and water solution or equivalent, while the system is under pressure.

3.2.5 Fuel Heater (Optional-MOH models only)

PECO fuel heaters are available on some MOH models. They are designed to provide heating of engine fuel for optimal performance of the Genset. The PECO Fuel Heater is designed to provide uninterrupted fuel flow in cold temperature environments when it is needed most. Factory Fuel Heater requires power source to be wired. See owner's manual for instructions.

3.2.6 Regulator (Optional)

Prime regulators are available on some models for fuel pressure reduction from source. Regulators vary by manufacturer and model. Check with your distributor or service technician for details on use and settings of your Regulator. Factory Regulator requires no further installation at site, connect fuel supply.

3.2.7 Fuel Filters (Optional-MOH models only)

Our in-line fuel filters are designed for optimal performance of the generator set. They provide the best choice for Customers who want to extend service intervals and increase Genset uptime. Optional pressure indicators and automatic drains are available on some models. Check the installation and service manuals for your specific filter (models vary by unit) for details. Factory Fuel Filter require no further installation at site, connect fuel supply.

3.3 Battery Selection

The minimum recommended reserve capacity (SAE RC) and cold cranking ampere (SAE CCA) values for a particular engine can be found on the Model specific Genset specification sheet is provided with the genset (visit www.cumminsnpower.com for genset specifications). RC and CCA definitions can be found in SAE Standard J537. All battery information is for lead/acid batteries.

3.3.1 Battery Requirements

For battery replacement information, refer to Figure 3-1. Batteries may be supplied by Cummins Distribution as an option, or may be supplied by the customer.

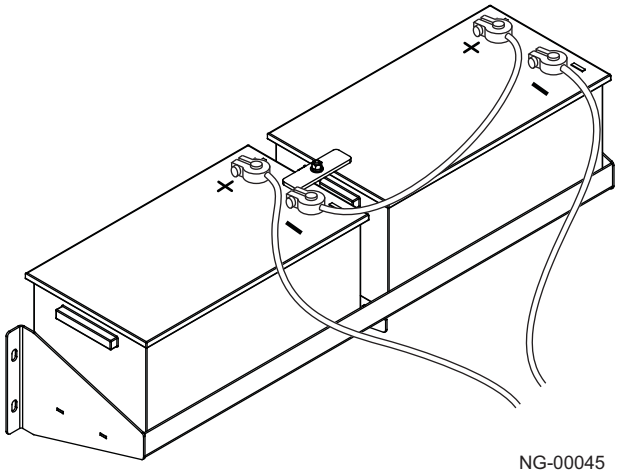


Figure 3-1 Series Battery Connection - 24 VDC

WARNING

Battery electrolyte (sulfuric acid) is highly caustic and can burn clothing and skin. Wear acid impervious neoprene gloves and safety goggles, or full face shield, when working with the batteries. Always disconnect the negative (-) battery cable first and attach the negative (-) battery cable last.

CAUTION

DO NOT connect battery charging cables to any electronic control system component. This can damage the electronic control system.

3.3.2 Battery Installation

1. Provide adequate room for servicing or replacing the batteries. Provide protection from extremes of temperature and weather.

2. Locate the batteries near the engine or increase the size of the conductors as required by applicable codes. Ensure that the batteries are configured properly for 24 VDC standard operations. Refer to Figure 3-1.

3. Check the battery cables and connections to ensure they are installed correctly and in good condition.

NOTE: *Coat the terminals with NOCO/Anti-OX to prevent corrosion. Install the cables and tighten the battery connections.*

WARNING

Batteries can emit explosive gases during charging. Always ventilate the compartment before servicing the batteries. Remove sources of spark or open flame. To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

3.4 Exhaust System

WARNING

Inhalation of exhaust gases can result in severe personal injury or death. Do not use exhaust heat to warm a room, compartment or storage area.

Pipe exhaust gases to the outside of any enclosure. Locate the exhaust outlets away from any air inlets to avoid gases re-entering the enclosure. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation and light loads. Regularly inspect the exhaust system both visually and audibly to see that the entire system remains fume tight and safe for operation.

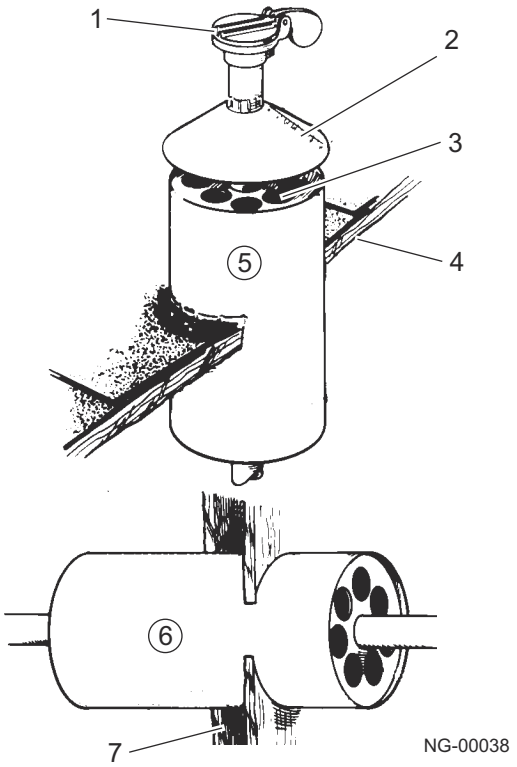
WARNING

Inhalation of exhaust gasses can result in severe personal injury or death. Use extreme care during installation to provide a tight exhaust system. Terminate exhaust pipe away from enclosed or sheltered areas, windows, doors and vents.

For indoor installation, the exhaust system shall use sealed joint type fittings, (for example NPT fittings) to provide a tighter exhaust system. Use of slip type fittings (secured with a muffler clamp) may allow leakage of exhaust gases into the building.

The exhaust system design should meet Federal, State and local code requirements.

Use an approved thimble (Figure 3-2) where exhaust pipes pass through walls or partitions. Insulated wall/roof thimbles are used where exhaust pipes pass through a combustible roof or wall. This includes structures, such as wood framing or insulated steel decking, etc. Uninsulated wall/roof thimbles are used where exhaust pipes pass through a non-combustible wall or roof, such as concrete. Refer to NFPA 37 Stationary Combustion Engines and Gas Turbines" for accepted design practices. Build according to the code requirements in effect at the installation site.



1. Rain Cap
2. Drip Cap
3. Holes in End of Inner Sleeve
4. Roof
5. Thimble in Vertical Orientation
6. Thimble in Horizontal Orientation
7. Wall of Partition

Figure 3-2 Mounting Exhaust Thimble

WARNING

Hot exhaust pipes can start a fire and cause severe injury or death if improperly routed through walls. Use an approved thimble where exhaust pipes pass through walls or partitions.

Rain caps are available for the discharge end of vertical exhaust pipes. The rain cap clamps onto the end of the pipe and opens due to exhaust discharge force from the generator set. When the generator set is stopped, the rain cap automatically closes, protecting the exhaust system from rain, snow, etc.

Use a section of flexible exhaust pipe between the engine and remainder of exhaust system. Support exhaust system to prevent weight from being applied to engine exhaust outlet.

CAUTION

Weight applied to the engine exhaust components can result in damage. Support the muffler and exhaust piping so no weight or stress is applied to engine exhaust.

IMPORTANT: *Liability for injury, death, damage, and warranty expense due to use of unapproved mufflers or modifications to the exhaust system becomes the responsibility of the person installing the unapproved muffler or performing the modification. Contact a Cummins NPower distributor for approved exhaust system parts.*

Avoid sharp bends by using sweeping, long radius elbows and provide adequate support for muffler and tailpipe. Pitch a horizontal run of exhaust pipe DOWNWARD (away from engine) to allow any moisture condensation to drain away from the engine. If an exhaust pipe must be turned upward, install a condensation trap at the point where the rise begins. Refer to Figure 3-3.

Shield or insulate exhaust lines if there is danger of personal contact. Allow at least 305 mm (12 in) of clearance if the pipes pass close to a combustible wall or partition. Before installing insulation on exhaust system components, check the exhaust system for leaks while operating the genset under full load and correct all leaks.

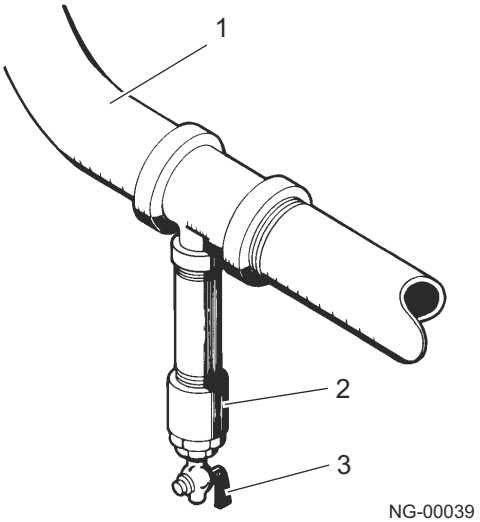
WARNING

Exhaust pipes are very hot and they can cause severe personal injury or death from direct contact or from fire hazard. Shield or insulate exhaust pipes if there is danger of personal contact or when routed through walls or near other combustible materials.

3.5 Installation of Sensors

On select model specific engines the natural gas, O2 and temp sensors to be mounted in exhaust ports located pre and post catalyst. See Figure 3-4 and Figure 3-5. Customer is responsible for installation of sensors. Reference AEB 10.124

NOTE: *4.00' clearance for insulation and other items around sensors is required.*



1. Exhaust Line
2. Condensation Trap
3. Valve Handle (shown in open position)

Figure 3-3 Condensation Trap

3.6 Air Fuel Ratio (AFR) Controller

Select model specific natural gas engines are equipped with an air fuel ratio controller, and are designed to meet emission requirements for EPA, SI, and NSPS codes. The engines are also capable of meeting NSPS emissions standards with an AFR controller and factory supplied catalyst.

The AFR control system uses a O_2 sensor architecture with catalyst, if applicable, to control exhaust emissions. The AFR control system controls fuel flow based on exhaust O_2. The controller opens or closes the fuel control valve (FCV) in the fuel line based on feedback from the O_2 sensor(s).

3.7 Catalyst-Removable Elements (Only available on some models)

Some Gensets require a 3-way or Oxidation catalyst to meet emission requirements. There is a precious metals element inside the housing of the catalyst that converts exhaust to EPA requirements. Some catalysts have a removable body that can be replaced with a new element when required. Most catalysts come installed on Genset from factory. Some catalysts require customer mounting. Check with your distributor or service technician for details on your product.

3.8 Engine 3-Way Catalyst (Model Specific)

The natural gas 3-way catalyst reduces the oxides of nitrogen (NO, NO_2), and hydrocarbons (HC) from the natural gas exhaust. Read this manual before installing, operating or servicing the engine equipped with a natural gas catalytic converter.

The natural gas 3-way catalyst, when installed properly, meets state and local emission reduction requirements on NO, NO_2, CO, and HC as OEM technology on stoichiometric natural gas engine. Removal of these devices without prior approval from the state and regulatory agencies can be constituted as tampering.

CAUTION

Handle the natural gas 3-way catalyst with care. Do not hammer or drop the unit. Do not weld or drill holes in the body of the natural gas 3-way catalyst without prior approval of Cummins® or its distributors.

3.8.1 Installation and Applications Guidelines

The following are recommendations for installation and application of natural gas 3-way catalyst for select models of natural gas engines. It is recommended that systems incorporating natural gas 3-way catalyst be designed by, or in conjunction with Cummins Engineering. In order to receive Cummins approval of the 3-way catalyst installation, the installation shall meet the following requirements. (Exceptions to these requirements shall be approved by Cummins Engineering.)

1. The 3-way catalyst and housing shall be the correct part number for the application.
2. The 3-way catalyst shall be mounted with a mounting system strong enough to support both the additional weight and dynamic loads.
3. It is recommended to use exhaust piping material compatible with the 3-way catalyst housing material, either cold-rolled steel or appropriate grade of stainless steel.
4. The exhaust piping shall be supported separately from the 3-way catalyst.
5. The 3-way catalyst is designed to be supported by the piping to which it is attached. See Figure 3-4 and Figure 3-5.

6. Do not impose external force(s) on the catalyst housing greater than 22.7 kg (50 lb) in any direction.

7. It is required to put a flexible tubing (i.e. bellows or flex pipe) between the engine and the beginning of the exhaust piping. This will isolate the 3-way catalyst and other downstream components from engine vibration.

8. For vertical flow mounting, ensure that the stack above the catalyst is independently supported. See Figure 3-5.

9. Avoid cantilevering loads off the end of the 3-way catalyst.

10. The engine oil shall meet CES 20074 or better specifications as required by the engine manufacturer.

11. The catalyst must be installed to guarantee air exhaust temperature into the catalyst of 482°-649° C (900°-1200° F). Any temperature outside this range may affect catalyst performance or life.

12. The catalyst can be installed either upstream or downstream of the silencer to obtain sufficient exhaust inlet temperatures.

3.8.2 Owner's Responsibilities

1. The owner is responsible for keeping the natural gas 3-way catalyst system on the equipment because the removal of the system may cause a violation of the local emission regulations.

2. The owner is responsible for periodic inspection of the system in accordance with these and other operational instructions.

3. The owner is responsible for maintaining the operation of the engine in a way that would NOT adversely affect the natural gas 3-way catalyst system. Any misfire, stack detonations, oil or debris in the exhaust system, shall be recorded in the equipment's service record.

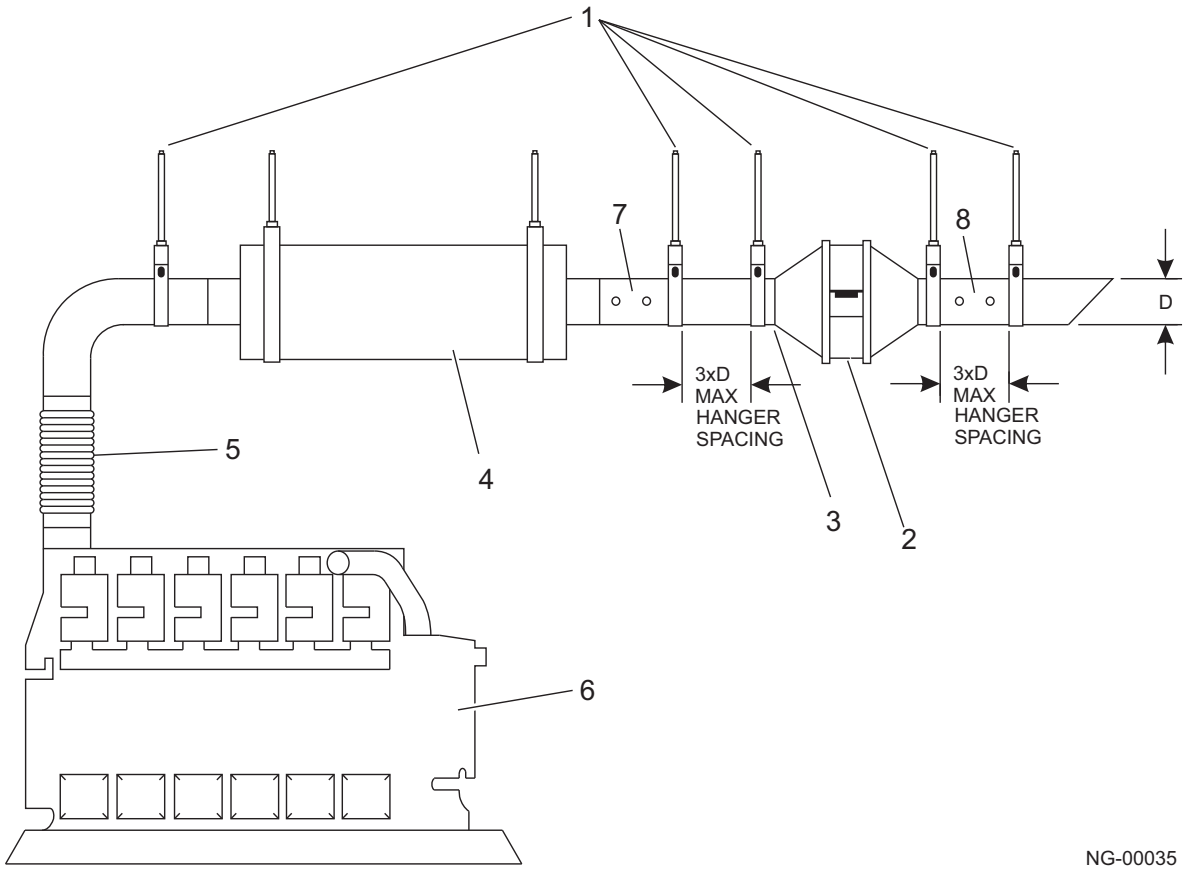
4. The owner is responsible for maintaining complete oil consumption and service records, as well as software files, where applicable, and to make them available to a requesting Cummins® authorized repair location for troubleshooting purposes.

3.8.3 Preparation

WARNING

Do not touch the surface of the existing silencer during or up to 30 minutes after operation. All surfaces are hot and can cause personal injury.

1. Ensure the engine ignition system and air-fuel ratio controller system is functioning properly per the manufacturer's specifications prior to starting installation of the 3-way catalyst.
2. Depress E-Stop.
3. Disconnect the equipment batteries.
4. Turn off the fuel supply.
5. Ensure the engine and auxiliary equipment are safely locked out and can not be engaged.



1. Hangers
2. 3-Way Catalyst (Model specific)
3. Air Exhaust Temperature 482°-649° C (900°-1200° F)
4. Silencer
5. Expansion Joint
6. Engine
7. Pre O2 and Temp Sensor Port (180° offset)
8. Post O2 and Temp Sensor Port

Figure 3-4 Recommended Horizontal Mounting Configuration (Typical)

3.8.4 3-Way Catalyst Installation

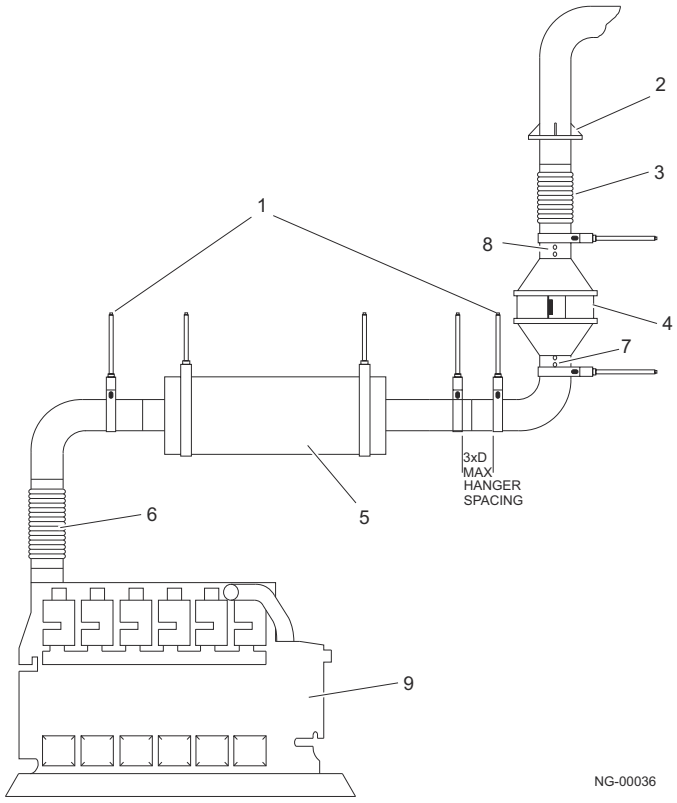
WARNING

To reduce the possibility of personal injury, use a hoist or get assistance to lift the assembly.

CAUTION

The existing exhaust pipe silencer hangers can not hold the weight of a natural gas catalyst. Install appropriate customer supplied natural gas 3-way catalyst mounting brackets.

1. Bolt the natural gas 3-way catalyst mounting bracket (supplied by the customer according to the application), to a solid structure.
2. Install the customer supplied mounting clamps to the natural gas 3-way catalyst housing. Tighten the mounting clamps enough to hold them in place (per Figure 3-4 and Figure 3-5) and to allow movement to connect the inlet and outlet exhaust pipes.
3. Connect the inlet and outlet exhaust pipes to the catalyst inlet and outlet.
4. Connect the customer supplied mounting clamps to the catalyst mounting bracket.
5. Tighten the natural gas catalyst mounting clamps.



1. Hangers
2. Fixed Support
3. Expansion Joint (optional)
4. 3-Way Catalyst
5. Silencer
6. Expansion Joint
7. Pre O2 and Temp Sensor Port (180° offset)
8. Post O2 and Temp Sensor Port
9. Engine

Figure 3-5 Recommended Vertical Mounting Configuration (Typical)

3.9 Air Fuel Setting and Emission Measurement

This procedure shall be performed at the time of installation of the natural gas 3-way catalyst, after any re-assembly, and periodically per schedule provided by manufacturer throughout the life of the 3-way catalyst.

Follow the air fuel ratio controller's instructions and engine manufacturer's instructions to set the air fuel ratio. Analyze the engine exhaust gases with a Nox, CO, or HC analyzer down stream of the 3-way catalyst.

If the emissions do not meet specifications, replace the catalyst module(s) as needed.

3.10 Ventilation and Cooling

Generator sets dissipate heat and fumes that must be removed by proper cooling and ventilation.

Generator sets in factory-mounted housings for outdoor installation are designed for proper cooling and ventilation.

Indoor installations require careful design with respect to cooling and ventilation. In an indoor installation, all radiator cooling air must be discharged outdoors. Duct adapter kits are available. See Figure 3-6 for a typical indoor installation.

⚠ WARNING

Engine or radiator cooling air may carry deadly carbon monoxide gas which can cause asphyxiation and death. All engine or radiator cooling air must be discharged outdoors. Do not use it for heating a room or compartment.

3.11 Vents and Ducts

For indoor installations, locate vents so incoming air passes through the immediate area of the installation before exhausting. Install the air outlet higher than the air inlet to allow for convection air movement.

Size the vents and ducts so they are large enough to allow the required flow rate of air. The "free area" of ducts must be as large as the exposed area of the radiator. Refer to the genset data sheet for the airflow requirements and allowed airflow restriction.

3.12 Oil Reservoir (Optional)

5 or 10 gallon Oil Tanks are optional on some units to allow for extended service intervals between maintenance. These tanks are typically plumbed to an Oil Maintainer Switch that controls the flow into the engine oil pan. It is imperative the switch is functioning properly without obstruction and if the switch is vented, the vent is not obstructed as well. The tank should be filled with oil per Engine Manufacturer guidelines.

3.13 Dampers

Dampers or louvres protect the generator set and equipment room from the outside environment. Their operation of opening and closing should be controlled by operation of the generator set.

In cooler climates movable or discharge dampers are used. These dampers allow the air to be recirculated back to the equipment room. This enables the equipment room to be heated while the generator set engine is still cold, increasing the engine efficiency.

3.14 Radiator Set Cooling Requirements

Radiator set cooling air is drawn past the control end of the set by a pusher fan that blows air through the radiator (Figure 3-6). Locate the air inlet to the rear of the set. Make the inlet vent opening 1-1/2 times larger than the radiator area.

NOTE: *Louvers and screens over air inlet and outlet openings restrict air flow and vary widely in performance. A louver assembly with narrow vanes, for example, tends to be more restrictive than one with wide vanes. The effective open area specified by the louver or screen manufacturer should be used.*

Locate the cooling air outlet directly in front of the radiator and as close as possible. The outlet opening must be at least as large as the radiator area. Length and shape of the air outlet duct should offer minimum restriction to airflow.

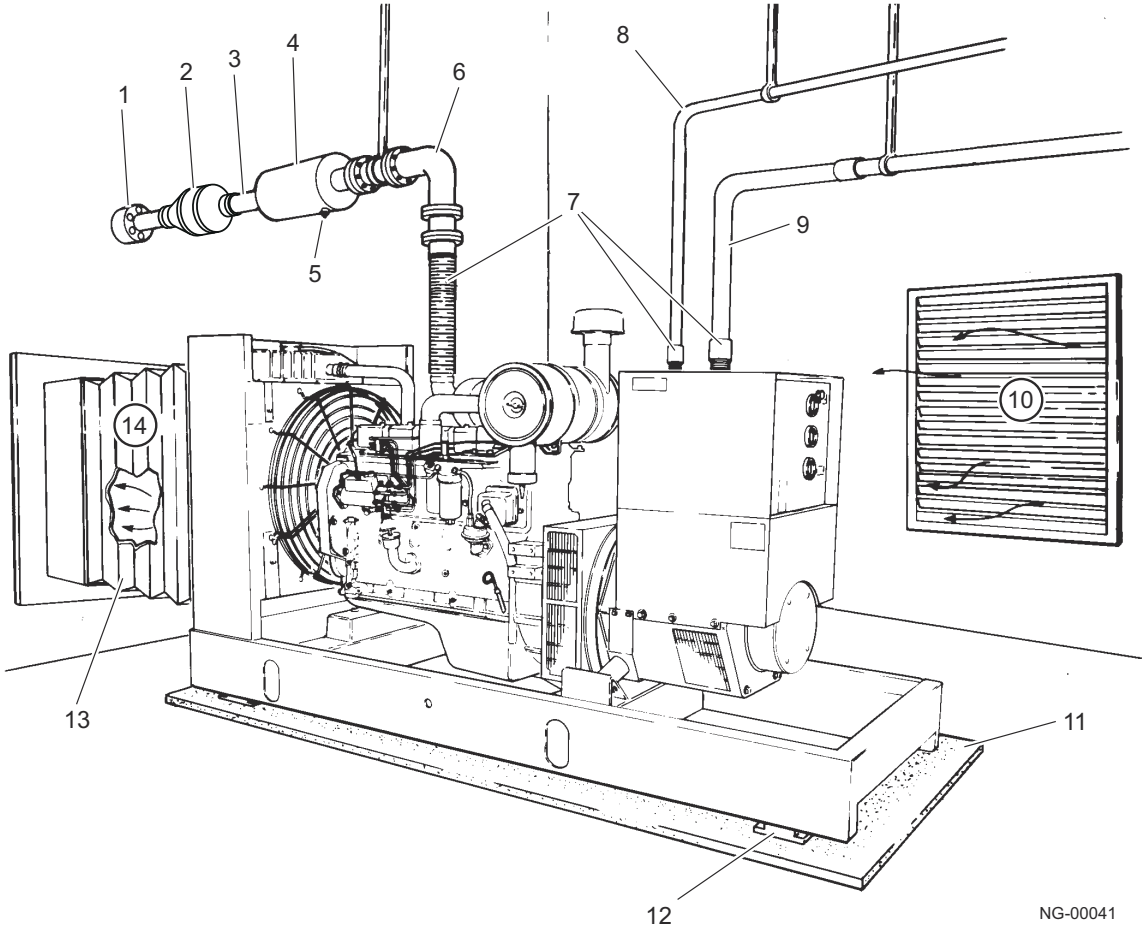
Attach a canvas or sheet metal duct to the air outlet opening using screws and nuts so duct can be removed for maintenance purposes. The duct prevents recirculation of heated air. Before installing the duct, remove the radiator core guard.

3.15 Remote Radiator Cooling Requirements (Available on All Models)

The remote radiator cooling system substitutes a remote mounted radiator and an electrically driven fan in place of mounted components. Removal of the radiator and the fan from the set reduces noise levels without forcing dependence on a continuous cooling water supply (necessary with heat exchanger cooling). The remote radiator installation must be completely protected against freezing.

Remote radiator plumbing will vary with installation. Follow recommendations given in Cummins Application Manual T-030. See product Data Sheet provided with the genset (visit www.cumminsnpower.com for genset specifications) for friction head and static head limits.

IMPORTANT: *Before filling cooling system, check all hardware for security. This includes hose clamps, capscrews, fittings and connections. Use flexible coolant lines with heat exchanger or remote mounted radiator options.*



1. Thimble
2. 3-Way Catalyst
3. Exhaust Line
4. Silencer
5. Condensation Drain Plug
6. Sweeping Elbow
7. Flexible Sections
8. Control Wiring
9. Power Wiring
10. Air Inlet
11. Level Concrete Base
12. Seismic Isolators (Optional)
13. Flexible Bellows
14. Air Outlet

Figure 3-6 Generator Set Installation (Typical)

Section 4 - Controls

4.1 Control System Overview

The PowerCommand Control (PCC) which is a microprocessor-based control can be provided in a mechanical and electronic version. All generator set control functions are contained on one circuit board (Base board). The Base board provides engine speed governing (optional), main alternator voltage output regulation, and complete generator set monitoring. The operating software provides control of the generator set and its performance characteristics and displays performance information on a digital display panel. It accepts menu-driven control and set-up input from the push button switches on the front panel.

For specific information on the control panel for your unit, please refer to the following documentation provided separately from this manual.

Description	Application	Part Number
PCC 1.1 (1302) Owner's Manual	Standby/Prime	900-0661
PCC 2.2 (2300) Operator Manual	Standby/Prime	900-0665
PCC 3.3 (3300) Owner's Manual	Standby/Prime/Paralleling	A029M414

Table 4-1

4.2 Control Wiring Installation

The generator set control panel box contains connection points for remote control and monitor options.

CAUTION

Stranded copper wire must be used for all customer connections to the control panel. Solid copper wire may break due to genset vibration.

Use flexible conduit for all wiring connections to the generator set. All conduit used for control wiring is attached to the control housing.

Route the control wiring through the control housing and access holes. Access holes should be used according to where the wires are terminated inside the control box.

A compression type strain-relief connector should be used to prevent dust, insects, etc. from entering the control box.

Use cable ties to keep control wiring away from sharp edges and AC power cables within the control housing.

4.3 Remote Monitor/Control Connections (PCC)

Customer monitor/control connections are attached to terminal block TB-1. Optional equipment such as a remote annunciator panel, sensing devices used to monitor genset operation, remote start/stop switches, battery charger, etc. are attached to TB-1. Refer to the customer connections diagram in Section 7 - Wiring Diagrams.

CAUTION

Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.

Table 4-2

Temperature rating of wire that is intended to be used for connection of the unit.	Copper conductors only	Aluminum conductors or copper-clad conductors[a]
		Row 1
60 or 75° C	Use either [b] AWG, 60° C or [c] AWG, 75° C copper wire.	Use 60° C wire, either [b] AWG copper or [b] AWG aluminum; or 75° C wire, either [c] AWG copper or [c] AWG aluminum.
		Row 2
60° C	Use [b] AWG, 60° C copper wire.	Use 60° C wire, either [b] AWG copper or [b] AWG aluminum.
		Row 3
75° C	Use [c] AWG, 75° C copper wire.	Use 75° C wire, either [c] AWG copper or [c] AWG aluminum.
		Row 4
90° C	Use [c] AWG, 90° C copper wire.	Use 90° C wire, either [c] AWG copper or [c] AWG aluminum.

[a] Reference to copper wire is not to be included when wiring terminals are intended for only the conductors specified in the code.

[b] The wire size for 60° C wire is not required to be included in the marking; however, when it is included, it shall be based on the ampacities given in Table 310-16 of the National Electrical Code, ANS/NFPA 70, for 60° C wire and the derating factor described in 12.1.3.

[c] The conductor size shall be no smaller than the larger of the following:

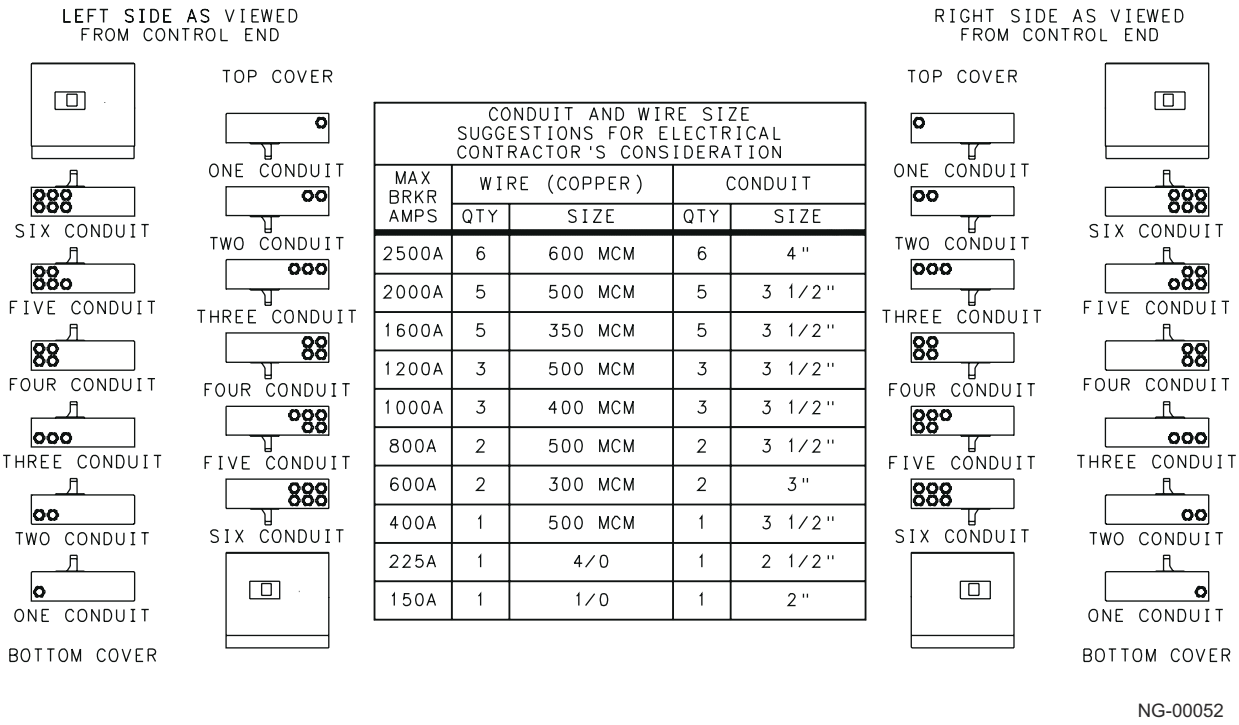
1. The conductor size used for the temperature test; or
2. The 75° C wire size based on the ampacities given in Table 310-16 of the National Electrical Code, ANSI/NFPA 70, and the derating factor described in 12.1.3.

Digital Connections: Connection points, other than relayed outputs, network, switched B+ and B+ are considered digital connections to terminal strip TB-1. The type/gauge wire to use for these connections are:

- Less than 305 m (1000 ft), use 20 gauge stranded copper wire.
- 305 to 610 m (1000 to 2000 ft), use 18 gauge stranded copper wire.

Relay Connections: Due to the wide variety of devices that can be attached to the relay outputs of TB1, the electrical contractor must determine the gauge of the stranded copper wire that is used at this installation site. Refer to PCC Customer Connections diagram in Section 7 - Wiring Diagrams.

Network Connections: Refer to 900-0366 Power-Command Network Installation and Operation Manual for the type/gauge wire to use for these connections or refer to Figure 4-1.



CONDUIT AND WIRE SIZE SUGGESTIONS FOR ELECTRICAL CONTRACTOR'S CONSIDERATION

MAX BRKR AMPS	WIRE (COPPER)		CONDUIT	
	QTY	SIZE	QTY	SIZE
2500A	6	600 MCM	6	4"
2000A	5	500 MCM	5	3 1/2"
1600A	5	350 MCM	5	3 1/2"
1200A	3	500 MCM	3	3 1/2"
1000A	3	400 MCM	3	3 1/2"
800A	2	500 MCM	2	3 1/2"
600A	2	300 MCM	2	3"
400A	1	500 MCM	1	3 1/2"
225A	1	4/0	1	2 1/2"
150A	1	1/0	1	2"

Figure 4-1

Switched B+: (Fused at 5 amps.) Same as Relay Connection description.

B+: (Fused at 10 amps.) Same as Relay Connection description.

4.4 Control Relays (Optional)

CAUTION

Damage to the base board can occur if the voltage suppressors are not installed across relay coils (A1/A2) of control relays K11, K12 and K13 before connecting genset battery cables.

The three optional control relays are rail mounted inside the control panel housing. Each relay is a 4-pole relay with 2 poles normally open and two poles normally closed.

These relays are used to control auxiliary equipment, such as fans, pumps and motorized air dampers. Energizing of the relays is user definable.

The contacts are rated at 10 amps at 600 VAC.

Refer to Customer Connections diagram in Section 7 - Wiring Diagrams.

4.5 AC Electrical Connections

This section provides the procedure that is used to connect the AC electrical system of the genset.

Before making any AC electrical connections, make certain the generator set cannot be accidentally started. Place the control panel run switch in the OFF position. Turn off or remove AC power from the battery charger, depress the E-Stop, and then remove the negative (-) battery cable from the set starting battery.

WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

Ventilate battery area before working on or near battery—Wear goggles—E-Stop gen set and disconnect charger before disconnecting battery

cables—Disconnect negative (-) cable first and reconnect last.

CAUTION

Disconnect battery charger from AC source before disconnecting battery cables. Otherwise, disconnecting cables can result in voltage spikes damaging to DC control circuits of the set.

WARNING

Accidental starting of the generator set can cause severe personal injury or death. Prevent accidental starting by disconnecting the negative (-) cable from the battery terminal.

WARNING

Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.

Connecting the genset AC electrical system involves:

- Installation of transfer switch
- Generator output voltage selection
- Load cable connection
- Standard and optional AC equipment connections (e.g., control box heater, coolant heater, etc.).

Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site. Contractor guidelines for appropriate conduit and wire sizing for this generator set can be found by referring to Figure 4-1.

WARNING

Improper wiring can cause a fire or electrocution, resulting in severe personal injury or death and/or property and equipment damage.

Before starting the genset, check to make sure that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation.

Check that the load cables from the genset are properly connected.

Socket Size Across Flats		Tightening Torque	
mm	inch	N-m	lb inches
3.2	1/8	5.1	45
4.0	5/32	11.4	100
4.8	3/16	13.8	120
5.6	7/32	17.0	150
6.4	1/4	22.6	200
7.9	5/16	31.1	275
9.5	3/8	42.4	375
12.7	1/2	56.5	500
14.3	9/16	67.8	600

Table 4-3

WARNING

Backfeed to utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after building main switch is opened.

4.6 AC Wiring

4.6.1 Generator Voltage Connections

The available generator output voltages and maximum current ratings are specified on the generator set nameplate. Line-to-neutral voltage is always the lower voltage shown and line-to-line voltage is the higher rating.

These generators can be configured to the nameplate voltages as shown on the Reconnection Diagram located in the generator manual supplied with this equipment. Many of the voltages listed will require reconfiguration of the generator output leads on the connection terminal block. This reconfiguration must only be done by service personnel that are trained and experienced to perform electrical installation. The generator set was adjusted to produce a specified voltage during production verification testing

prior to shipment. The installer must always check the stator lead terminal block connections and perform any necessary reconnect to obtain the voltage required. Refer to applicable Alternator Installation, Service & Maintenance Manual as identified in Table 4-4 .

Description	Application	Part Number
Alternator Installation, Service and Maintenance Manual	UCI, UCM, UCD 224 & 274	UCH-027
Alternator Installation, Service and Maintenance Manual	HCI Series	UCI-056

Table 4-4

Some generator sets are capable of producing a wide range of voltages and connection configurations, others have specific limited capabilities. Refer to wiring diagram and generator voltages (from the nameplate) when reviewing the voltage connection information and use the wiring diagram supplied with your generator set when actually performing load connections.

CAUTION

Reconfiguring generator sets to higher voltages can exceed the voltage capability of the specific generator windings. This will damage the generator, decrease line current, and render line circuit breakers too large. Consult with your distributor before performing reconnection for a different voltage.

CAUTION

Reconfiguring generator sets to lower voltages can reduce generator set ratings, and also increase line current, rendering line circuit breakers too small. Consult with your distributor before performing reconnection for a different voltage.

4.6.2 Load Connections

Flexible conduit and stranded conductors must be used for connections to take up movement of the generator set.

All loads are connected to the generator by bolting stranded load wires to the appropriate terminals on the generator reconnection terminal block or circuit breaker lugs. The terminals are stamped U, V, W and N to indicate the line and neutral connections. (Reference: U, V, and W correspond with L1, L2 and L3; and N with L0 respectively).

4.6.3 Load Balancing

When connecting loads to the generator set, balance the loads so the current flow from each line terminal (L1, L2 and L3) is about the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading can be used as long as each line current is about the same, within 10 percent of median value and no line current exceeds the nameplate rating of the generator. Check the current flow from each line after connections by observing the control panel display.

4.6.4 Current Transformers

The CT's must be installed as noted in the following CT Installation Requirements.

Refer to the reconnection diagram to identify the output leads/phase that must be routed through each CT, and also appropriate transformer post selection for meter sensing leads. The transformers are labeled CT1, CT2 and CT3 on the reconnection wiring diagram. (The reconnection diagram is located on the upper side cover of the control housing.)

CT Installation Requirements:

The CT has a dot on one side. This dot must be facing toward the generator (conventional current flowing into the dot). A dot is also used to indicate pin 1 of the CT.

a. CT1 - U load leads (A phase)

b. CT2 - V load leads (B phase)

c. CT3 - W load leads (C phase)

d. Route the appropriate load wires through each CT. The CT's have dual secondaries (3 posts). The CT secondary wire marked 1 is connected to post 1 of the CT. CT secondary wire marked 2/3 is connected to post 2 for high voltage gensets or to post 3 for low voltage gensets. (Refer to the Reconnection Diagram in Section 7 - Wiring Diagrams.)

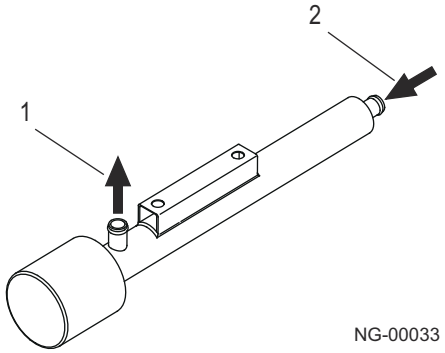
4.7 Coolant Heater (Optional)

CAUTION

The coolant heater must not be operated while the cooling system is empty or damage to the heater will occur.

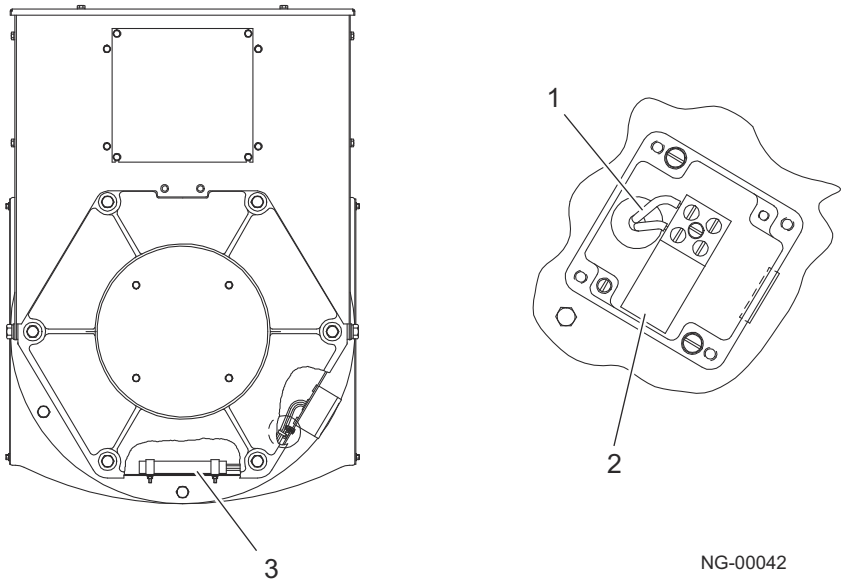
Coolant heaters keep the engine coolant warm when the engine is shut down. It heats and circulates the coolant within the engine. This reduces startup time and lessens engine wear caused by cold starts. It is electrically operated and thermostatically controlled.

Figure 4-2 shows a typical coolant heater. Connect the heater to a source of power that will be on during the time the engine is not running. Be sure the voltage rating is correct for the heater element rating and that the thermostat is set to the correct temperature prior to starting.



1. Coolant Outlet
2. Coolant Inlet

Figure 4-2 Coolant Heater



1. Heater Leads
2. Heater Terminal Box
3. Heater

Figure 4-3 Generator Heater Installation (Typical)

4.7.1 Battery Heater (Optional)

Battery heaters ensure the batteries are ready for starting the engine in cold standby conditions. They also protect against condensation during standby and prevent corrosive damage of electrical components in high humidity environments. Factory Battery Heater requires power source to be wired. See owner's manual for instructions.

4.7.2 Control Heater (Optional)

Control heaters protect the control cabinet components from condensation during standby and prevent corrosive damage of electrical and mechanical components in high humidity environments. Heaters are available for most PowerCommand Controls models. Factory Control heater is wired and requires no further installation at site.

4.7.3 Breather Heater (Optional)

This heater is designed to prevent crankcase breather freezing. The heater has a set point of 50° F. If the ambient temperature inside the enclosure drops below 50° F, the heater will automatically switch on. Factory Breather heater is wired and requires no further installation at site.

4.8 Generator Heater (Optional)

WARNING

Water or moisture inside a generator increases the possibility of flashing and electrical shock, which can cause equipment damage and severe personal injury or death. Do not use a generator which is not dry inside and out.

A generator heater(s) is used to help keep the generator free of condensation when the generator set is not running. During cool and humid conditions, condensation may form within a generator, creating flashing and shock hazards.

Figure 4-3 illustrates the installation of two heater elements. Connect the heater(s) to a source of power that will be on during the time the engine is not running. Power connections are made to the terminal block in the heater terminal box. Be sure the voltage rating is correct for the heater element rating.

Section 5 - Pre-Start Preparation

Before attempting the initial start of the generator set, be sure to complete the Installation Checklist in Section 6.

5.1 Electrical System

Verify all electrical connections are secure and all wiring is complete and inspected. Replace and secure any access panels that may have been removed during installation.

5.2 Battery Connections

WARNING

Accidental starting of the generator set can cause severe personal injury or death. Make sure that the Run/Off/Auto switch on the control panel is set to the Off position before connecting the battery cables.

Starting the unit requires batteries per the model specific genset data sheet as provided with the genset (visit www.cumminsnpower.com to locate specifications). E-Stop the genset before the connection or disconnection of battery cables. Connect positive battery cable before connecting negative battery cable to prevent arcing.

Service the batteries as necessary. If an automatic transfer switch is installed without a built-in charge circuit, connect a separate battery charger. A battery charger is required when the PowerCommand Controller is set to the Awake mode.

5.3 InPower Service Tool General Information (PCC)

InPower is a PC based service tool for the PowerCommand Controller (PCC) to be used by Cummins authorized factory service technicians. InPower is used to:

- Make adjustments to the controls trims and settings.
- Perform diagnostics and monitoring.
- Create a capture file of the controls trims and settings.
- Update control calibrations (InPower PRO version).

WARNING

Ignition of explosive battery gases can cause severe personal injury or death. Always connect negative (-) battery cable last to prevent arcing.

WARNING

Ventilate battery area before working on or near battery. Arcing at battery terminals, light switch or other equipment, flame, pilot lights and sparks can ignite battery gas. Do not smoke, or switch trouble light ON or OFF near battery. Discharge static electricity from body before touching batteries by first touching a grounded metal surface.

5.4 PCC Options Pre-Start Checks

All generator set configuration options are set at the factory except for site related options, (e.g., Language, Start/Stop Time Delays, Cycle Crank, Customer Fault 1 and 2, etc.

Adjustment of these options are divided into two categories within the menu driven system. These two categories are *Setup* and *Controller Configuration/ Adjust.*

The *Setup* submenus are intended for qualified service personnel only and require a password to modify these submenus. The *Controller Configuration* and *Adjust* submenus are intended for service personnel and site personnel.

The *Controller Configuration*, submenus are used to change the default language, temperature units, and pressure units to be displayed in menus.

The *Adjust* submenus allow site personnel to calibrate the generator set voltage/frequency, idle speed and start/stop time delays. For the pre-start checks, adjustment of only the start/stop delays is required. Refer to the model specific Power Controller (PCC) Manual for installation, operator, and service information per Table 4-1 .

5.5 Start Up Procedure

Refer to the appropriate Operator Manual for important safety precautions and recommended procedures for starting the genset and verifying proper operation. Start the generator set and verify all engine and generator menus are displaying the correct values.

5.6 Emissions Requirements

WARNING

It is the owner/operator's responsibility to complete site specific emission requirements to ensure compliance with the US EPA SI NSPS.

Emissions on this Generator Set must be dialed-in at the job-site per the following requirements before operation:

GTA855E refer to manual 4325956 and AEB 10.124 and 24.52

KTA19SLB and QSK19 refer to AEB 28.07

5.7 Fuel Pressure and Mixture Adjustments

WARNING

Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not allow cigarettes, flame, pilot lights, arcing switches or equipment in area or areas sharing ventilation. Keep a type ABC fire extinguisher nearby.

WARNING

Natural gas is lighter than air, and will tend to gather under hoods. LPG is heavier than air, and will tend to gather in sumps or low areas. NFPA Standard No. 58 requires all persons handling and operating LPG to be trained in proper handling and operating procedures.

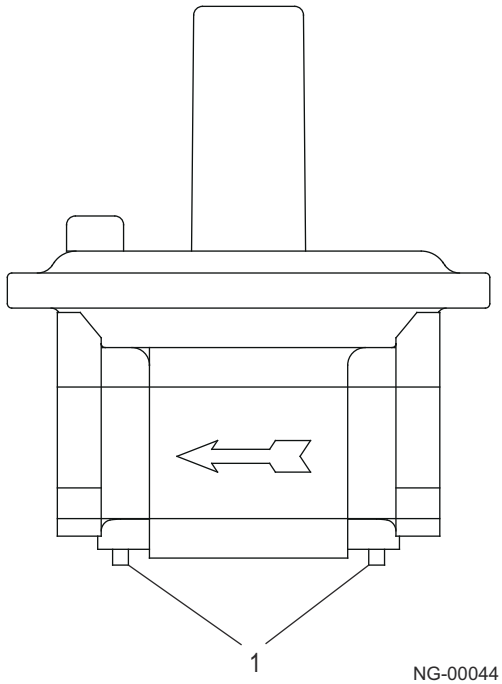
WARNING

Do not attempt to correct power by adjusting fuel system before determining that the engine and the ignition system are functioning properly. Especially check air cleaner restriction due to dirt accumulation.

IMPORTANT: *Read the warranty statement provided with the genset for US Environmental Protection Agency (EPA) restrictions on servicing specific components.*

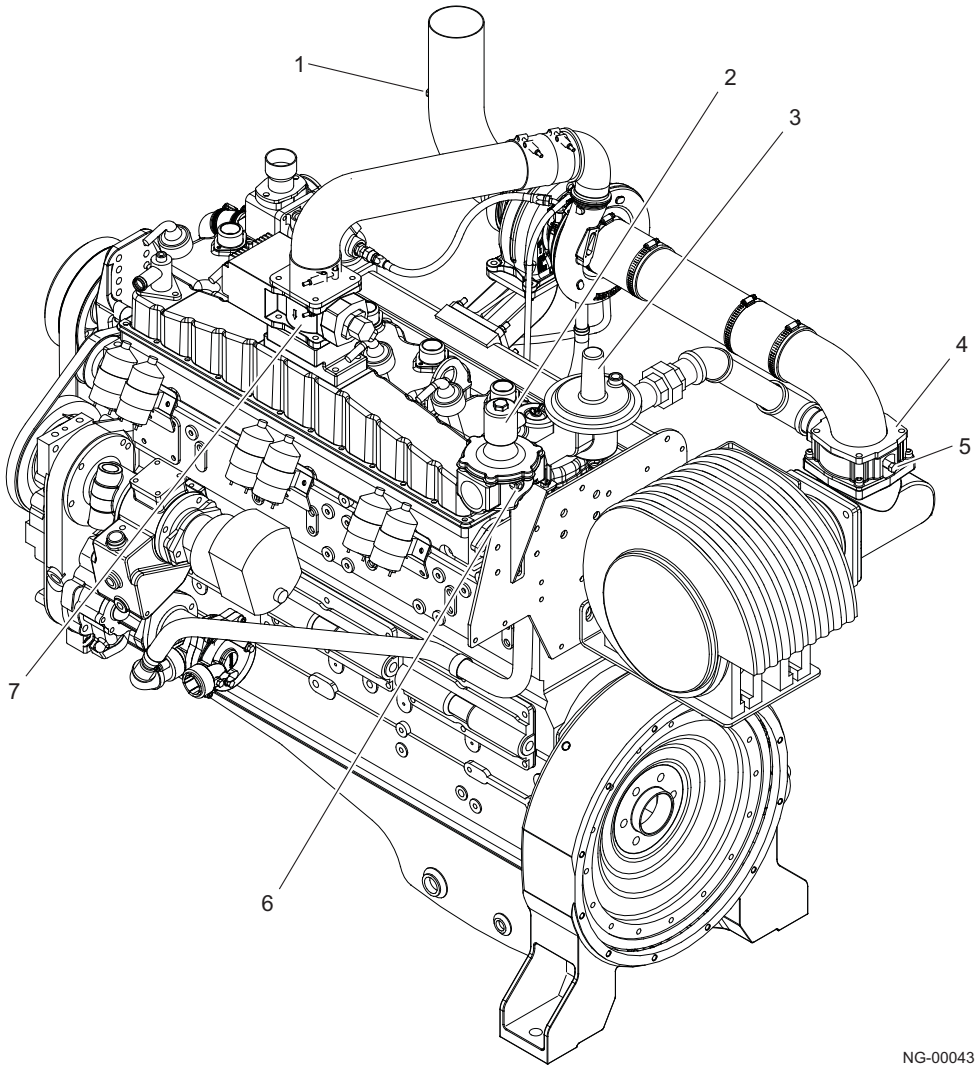
5.7.1 Fuel Supply Pressure

The fuel supply pressure must be 3.75-5 kPa (15-20 inches WC) under full-load operation not to exceed 5.0 kPa (20 inches WC) under any condition. See Figure 5-1 for the pressure test ports.



1. Pressure Test Port (2)

Figure 5-1 Demand Regulator (Natural Gas)



1. Air-Fuel Mixture Test Port
2. Solenoid Valve
3. Demand Regulator
4. Carburetor
5. Fuel Mixture Adjuster
6. Natural Gas Supply Pressure Test Port
7. Throttle Body/Governor Actuator

Figure 5-2 Natural Gas Fuel System (Typical)

5.7.2 Fuel System Components

Engine is equipped with one shut-off solenoid valve and a demand pressure regulator. Gensets for optional liquid withdrawal of propane are equipped with a converter that vaporizes the fuel with hot engine coolant. See Figure 5-2 for a typical fuel system. A genset equipped for dual fuel, natural gas and propane, has a gas mixer that serves both fuels. A fuel pressure switch to detect loss of natural gas pressure is provided for automatic changeover to propane while the engine is running. Manual shut-off valves are provided in each supply line for manual changeover systems.

5.7.3 Fuel System Operation

During normal operation, the engine fuel/air ratio is determined by the fuel trim valve operating in conjunction with the oxygen sensor and the air/fuel control module. Your authorized Cummins distributor can monitor fuel system/oxygen sensor operation using the service tool.

5.7.4 Fuel Mixture Adjustments

IMPORTANT: *Always use Nox and CO test equipment to set emission levels.*

1. Check for recommended fuel supply pressure 3.7-5.0 kpa (15-20 inches WC) at engine mounted regulator

2. Check the operation of fuel shut-off solenoids.

5.7.4.1 Electronic Engines

For electronic engines:

• Model GTA855E see Cummins AEB 24.51.

• Model KTA19 SLB and QSK19, see Cummins AEB 28.07. Model 150 GFPA, GFMC, and GCDC are self adjusting per engine manufacturer. Visit www.psiengines.com for additional information and updates.

5.7.4.2 Non-Electronic Engines

Some engines are site compliant capable. Generator set certification is per local, regional and national codes and may require frequent site testing. A summary of the testing procedure is listed here. For non-electric engines, apply 100% load.

1. Install the emission tester in the exhaust post catalyst. The emission tester needs to read Nox and CO in grams per break horsepower (g/bhp). Install an O_2 meter per catalyst in port on turbo exhaust elbow.

2. Connect the laptop to RS232 connection at the Gill air-fuel ratio controller module. Start the engine. Click on the Gill icon when connected, click on View, then click on Fuel Valve Control. (The engine has to be running for the laptop to connect to the air-fuel ratio controller.)

3. On the screen, go to the Mode column, and click on Open Loop. The air-fuel valve will go to the closed position.

4. Apply full generator name plate load.

5. All adjustments and emission readings need to be at full load of the generator rating.

6. Run at full load for 5 minutes. Check O_2 at the turbo exhaust elbow. It should be at 0.5. If O_2 is not at 0.5, proceed to step 7. If at 0.5, proceed to step 10. THIS READING NEEDS TO BE WITH AFR IN OPEN LOOP.

7. Adjust the carburetor air-fuel mixing screw. If O_2 is above 0.5, turn screw out. This will lower the O_2 setting. If O_2 is below 0.5, adjust the carburetor screw in, this will raise the O_2.

8. Run the engine for 5 minutes and check the O_2 setting. Repeat adjustment until O_2 is at 0.5.

9. Under the Mode column, click on Close Loop, and the fuel valve will open.

10. Run the engine for 5 minutes. Check the exhaust emissions. Emission should be under 4 g/hp for CO and under 2 g/hp for Nox. O_2 reading, post catalyst should be 0.0 to -0.3.

11. O_2 reading at the turbo exhaust elbow should drop to about 0.1.

12. If the emission readings are not correct, the air-fuel ratio controller will need to be adjusted.

13. Under the Control column, record the number in the set point box. (This is in case you need to go back and start from the beginning).

14. Double click on the set point box. It will turn red. Now you can change the set point value.

15. Change the set point value in small increments (sample if the set point is -0.1550, change to -0.1750), click Enter on the laptop. This will save the new set point and the box will change back to white.

16. Wait 5 to 10 minutes after every adjustment before taking the emission readings. Be very patient doing this part of the set up. Making a change to the setting before emissions have stabilized will make it very difficult to get AFR adjusted correctly.

17. As the set point value goes up, the valve will open more.

18. Under output, you will see % Open and Steps. This is the amount the valve is open. The maximum opening is 200 steps.

19. The CO and NOx reading will fluctuate.

Section 6 - Installation Checklist

6.1 General

□ Generator set wattage capacity is sufficient to handle maximum anticipated load.

□ At least.91 m (3 ft) of clearance (or greater for housing door) is provided around entire generator set for servicing and ventilation.

□ Generator set is located in an area not subject to flooding.

□ All operating personnel have read and are familiar with Operator Manual.

□ All operators have been thoroughly briefed on preventive maintenance procedures.

□ All operators have read and understand all Important Safety Instructions in Operator Manual.

6.2 Generator Set Support

□ Floor, roof or earth on which the generator set rests is strong enough and will not allow shifting or movement. Observe local codes on soil bearing capacity due to freezing and thawing.

□ Generator set is properly supported and retained to approved base.

□ Supporting base is large enough and is of non-combustible materials.

6.3 Cooling Air Flow

□ Generator set air inlet is faced into direction of strongest, prevailing winds.

□ Air inlet openings are unrestricted and at least 1-1/2 times larger than air outlet area.

□ Cooling air outlet is on downwind side of building (if not, wind barrier is constructed).

□ Proper ducting material (sheet metal, canvas) is used between radiator and air outlet.

6.4 Fuel System

□ Fuel tanks meet or exceed all Local, State or National codes.

□ Fuel lines are properly installed, supported and protected against damage.

□ Approved flexible fuel line is installed between main fuel supply line and generator set's fuel system, near the generator set, to protect the fuel system from damage caused by vibration, expansion and contraction.

□ Fuel supply line shutoff valve is installed to prevent fuel flow in case of leaks.

□ No fuel leaks are found in supply line or engine fuel system.

6.5 Exhaust System

□ Operators are thoroughly briefed on the dangers of carbon monoxide gas.

□ Areas around set are well ventilated. No possibility of exhaust fumes entering building doors, windows, or intake fans.

□ Exhaust gases are piped safely outside and away from building.

□ The correct length of approved rigid pipe is connected to the generator set flexible pipe using approved securing methods with no weight resting on engine exhaust components. There are no bends in flex section.

□ Condensation drain is provided in lowest section of exhaust piping.

□ Exhaust piping is insulated to guard against burns to personnel.

□ Exhaust piping passing through walls or ceilings have approved fire-proof materials and are in compliance with all codes.

□ Exhaust piping is large enough in diameter to prevent excessive back pressure on engine.

□ For model GTA855E, verify O2 and temperature sensors are installed pre and post catalyst.

6.6 AC And DC Wiring

□ Wire sizes, insulation, conduits and connection methods all meet applicable codes.

□ AC and DC wires are separated in their own conduit to prevent electrical induction.

□ All load, line and generator connections are proper and correct.

□ Flexible conduit between generator set and building or surrounding structure.

6.7 Generator Set Pre-Start

□ Generator set engine is properly serviced with oil and coolant.

□ E-Stop is depressed.

□ Batteries are properly installed, serviced and charged.

□ Battery charger and engine coolant heater are connected and operational.

□ All generator set covers and safety shields are installed properly.

Section 7 - Wiring Diagrams

7.1 General

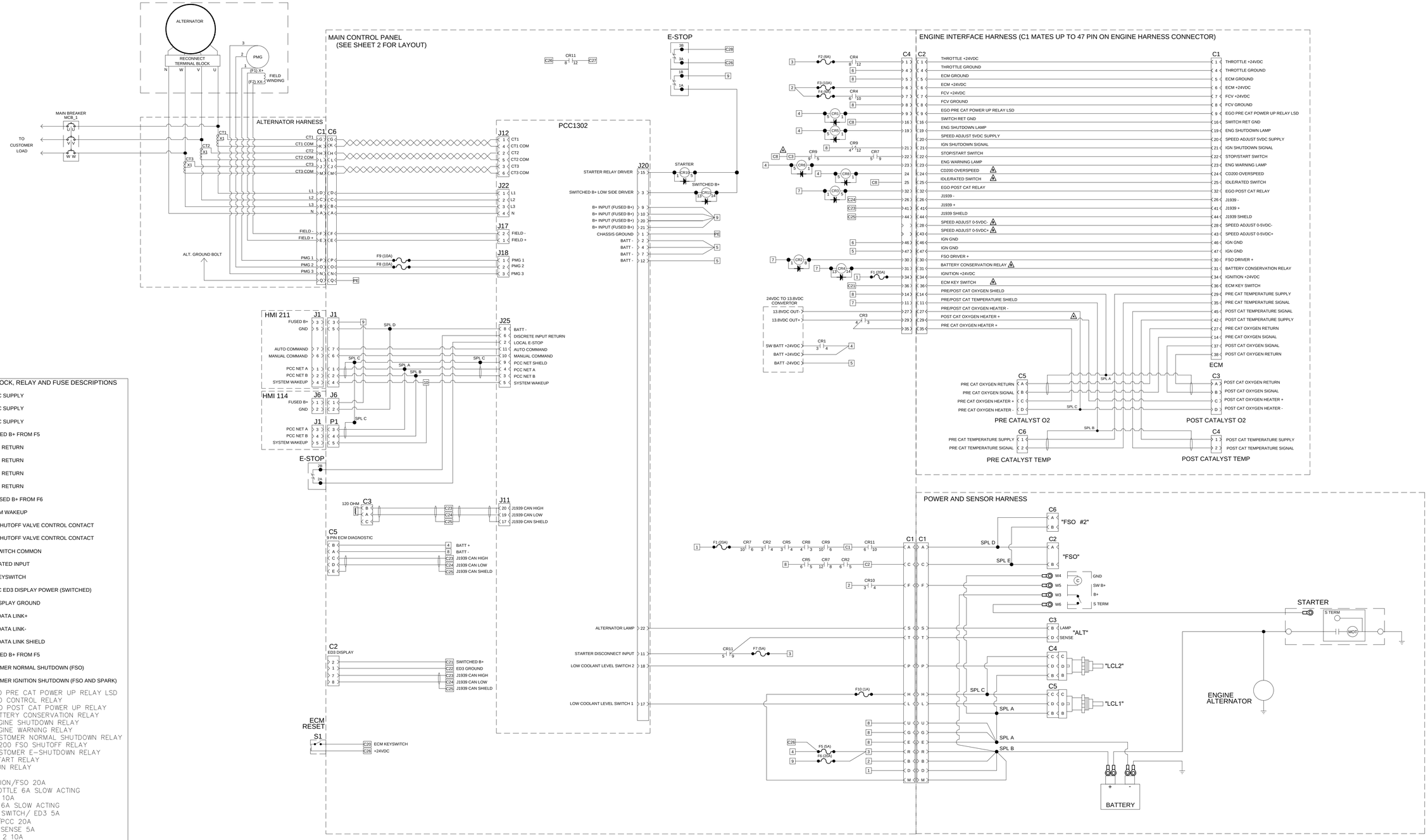
This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

Wiring Diagrams - Electronic Engines

Drawing Title	Drawing No.	Rev.
Schematic, Controls Interface GFBC GTA855E w/ PCC 1302	GFBC-PCC1.3-Wiring	B
Schematic, Controls Interface GFBC GTA855E w/ PCC 2300	GFBC-PCC 2.3-Wiring	B
Schematic, Controls Interface GFBC GTA855E w/ PCC 3300	GFBC-PCC 3.3-Wiring	B
Schematic, Controls Interface GFEB KTA19SLB w/ PCC 1302	GFEB-PCC1.3-Wiring	A
Schematic, Controls Interface GFEB KTA19SLB w/ PCC 2300	GFEB-PCC 2.3-Wiring	A
Schematic, Controls Interface GFEB KTA19SLB w/ PCC 3300	GFEB-PCC 3.3-Wiring	A
Schematic, Overall GFPA Model 150 w/PCC 1.1/PCC 2.2	22726	-

Wiring Diagrams - Hydro-Mechanical Engines

Drawing Title	Drawing No.	Rev.
Schematic, Controls Interface HM ENG w/PCC 1302	25538	-
Schematic, Controls Interface HM ENG w/PCC 3300	25539	-



TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	+24VDC SUPPLY
3	+24VDC SUPPLY
4	5A FUSED B+ FROM F5
5	-24VDC RETURN
6	-24VDC RETURN
7	-24VDC RETURN
8	-24VDC RETURN
9	20A FUSED B+ FROM F6
10	SYSTEM WAKEUP
C1	FUEL SHUTOFF VALVE CONTROL CONTACT
C2	FUEL SHUTOFF VALVE CONTROL CONTACT
C3	ECM SWITCH COMMON
C8	IDLE/RATED INPUT
C20	ECM KEYSWITCH
C21	+24VDC ED3 DISPLAY POWER (SWITCHED)
C22	ED3 DISPLAY GROUND
C23	J1939 DATA LINK+
C24	J1939 DATA LINK-
C25	J1939 DATA LINK SHIELD
C26	5A FUSED B+ FROM F5
C27	CUSTOMER NORMAL SHUTDOWN (FSO)
C28	CUSTOMER IGNITION SHUTDOWN (FSO AND SPARK)

CR1 = EGO PRE CAT POWER UP RELAY LSD
CR2 = FSO CONTROL RELAY
CR3 = EGO POST CAT POWER UP RELAY
CR4 = BATTERY CONSERVATION RELAY
CR5 = ENGINE SHUTDOWN RELAY
CR6 = ENGINE WARNING RELAY
CR7 = CUSTOMER NORMAL SHUTDOWN RELAY
CR8 = CD200 FSO SHUTOFF RELAY
CR9 = CUSTOMER E-SHUTDOWN RELAY
CR10 = START RELAY
CR11 = RUN RELAY

F1 = IGNITION/FSO 20A
F2 = THROTTLE 6A SLOW ACTING
F3 = ECM 10A
F4 = FCV 6A SLOW ACTING
F5 = KEY SWITCH/ ED3 5A
F6 = HMI/PCC 20A
F7 = ALT SENSE 5A
F8 = PMG 2 10A
F9 = PMG 1 10A
F10 = LOW COOLANT LEVEL 1A

S1 = CONTROLLER RESET

LEGEND

CR# = RELAY COIL

CR# = RELAY CONTACT

10 = TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021936-02 FOR ENGINE SIDE WIRING AND INTERFACE

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
B	2014-109	CORRECTED PINOUTS BETWEEN C1 & C2.	RMJ	25FEB2014
A	2013-721	ADDED JUMPER WIRE BETWEEN TERMINALS C3 & C8. REMOVED C7. FIXED O2 WIRING. ADDED SHEET 3.	KAK	25NOV2013

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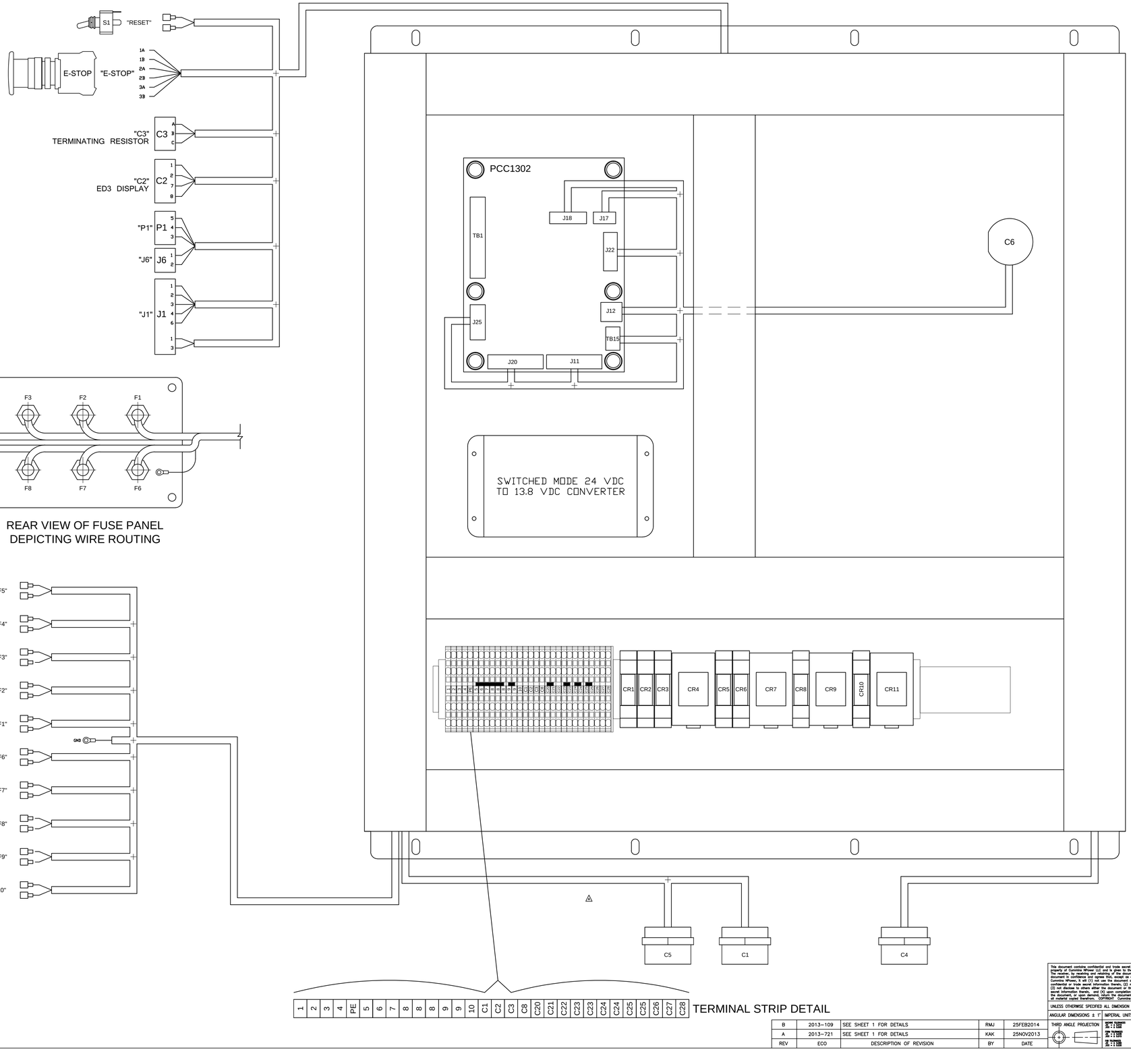
CUSTOM DESIGN AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE
GTA855E w/ PCC1302

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 2 SEPT 2011
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 10F3
DRAWING NO: GFBC-PCC1.3-WIRING



REV	ECO	DESCRIPTION OF REVISION	BY	DATE
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A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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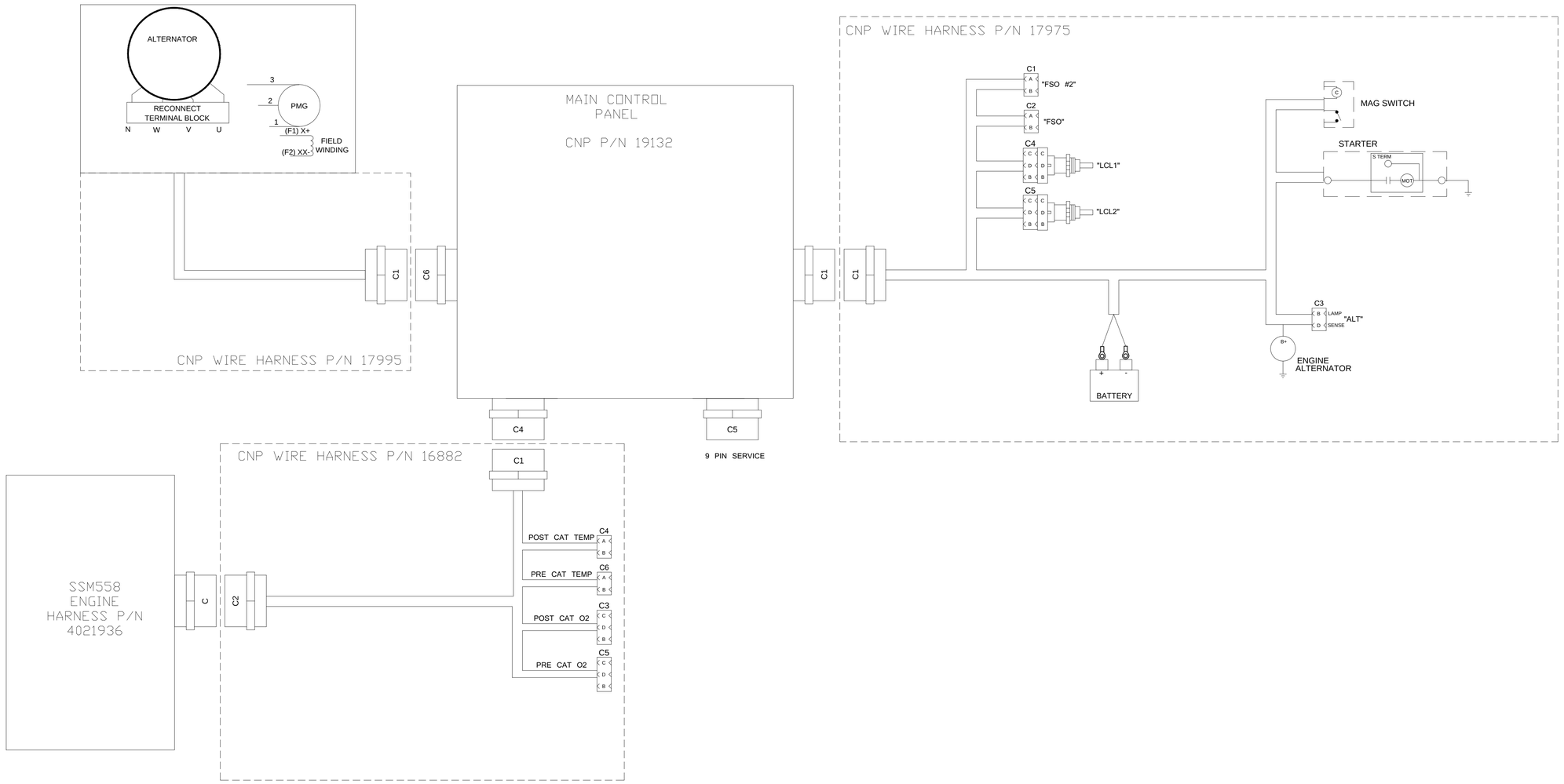
SCHEMATIC, CONTROLS INTERFACE GTA855E w/ PCC1302

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 2 SEPT 2011
SCALE:	AUTO CAD	INIT ECO:
EST WEIGHT:	SHEET 20F3	DRAWING NO: GFBC-PCC1.3-WIRING



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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

DRAWN BY: KAK | DATE: 02 SEPT 2011

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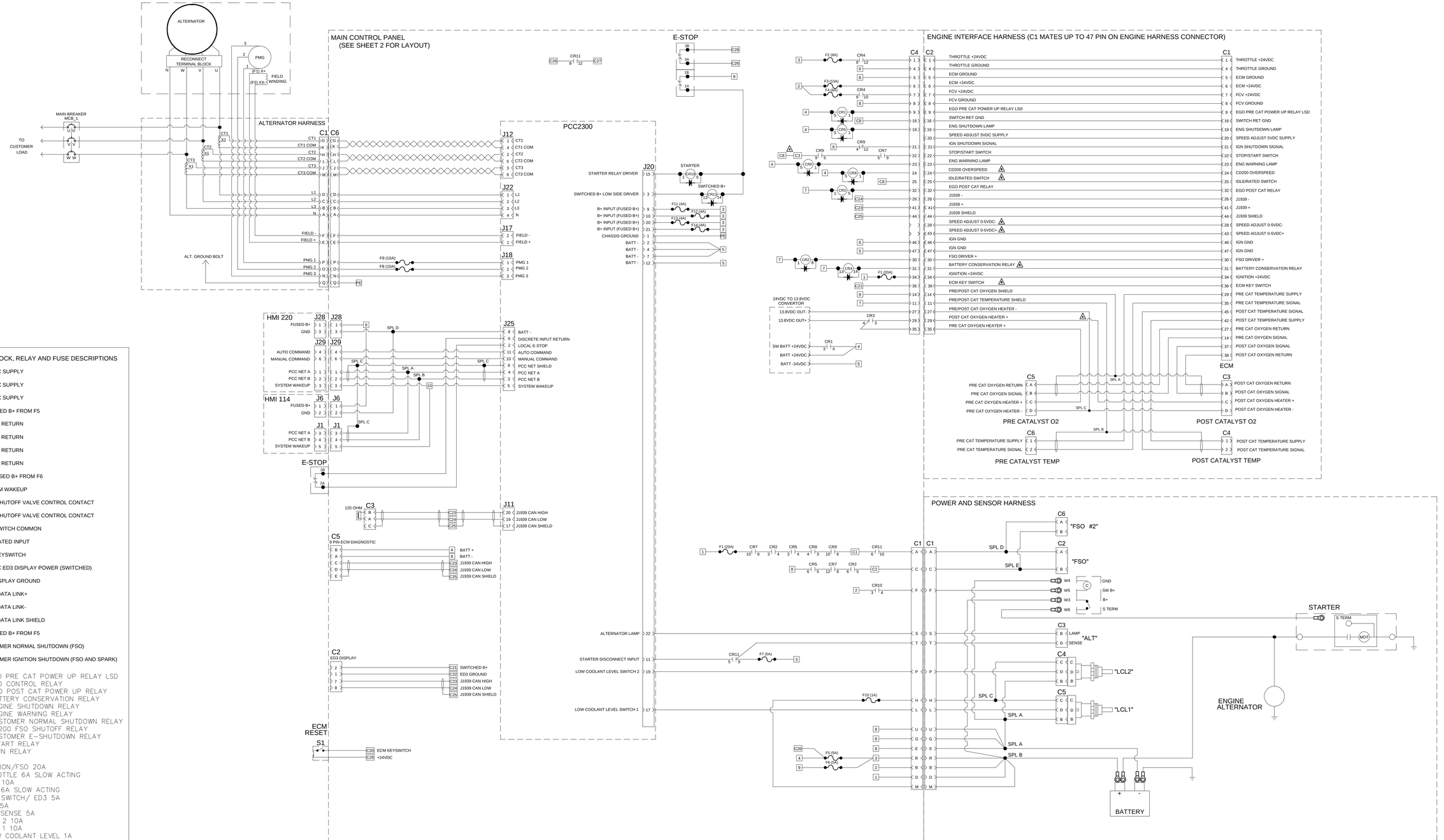
SCALE: | EST WEIGHT: | SHEET 30F3 | DRAWING NO: GFBC-PCC1.3-WIRING



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8	-24VDC RETURN
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C8	IDLE/RATED INPUT
C20	ECM KEYSWITCH
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C22	ED3 DISPLAY GROUND
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C24	J1939 DATA LINK-
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CR8 = CD200 FSO SHUTOFF RELAY
CR9 = CUSTOMER E-SHUTDOWN RELAY
CR10 = START RELAY
CR11 = RUN RELAY

F1 = IGNITION/FSO 20A
F2 = THROTTLE 6A SLOW ACTING
F3 = ECM 10A
F4 = FCV 6A SLOW ACTING
F5 = KEY SWITCH/ ED3 5A
F6 = HMI 5A
F7 = ALT SENSE 5A
F8 = PMG 2 10A
F9 = PMG 1 10A
F10 = LOW COOLANT LEVEL 1A
F11 = PCC B+ 4A
F12 = PCC B+ 4A
F13 = PCC B+ 4A
F14 = PCC B+ 4A

S1 = CONTROLLER RESET

LEGEND

CR# = RELAY COIL

CR# = RELAY CONTACT

10 = TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021936-02 FOR ENGINE SIDE WIRING AND INTERFACE

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
B	2014-109	CORRECTED PINOUTS BETWEEN C1 & C2.	RMJ	25FEB2014
A	2013-721	REMOVED C7. FIXED O2 WIRING. ADDED SHEET 3. ADDED JUMPER BETWEEN TERMINALS C3 & C8.	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

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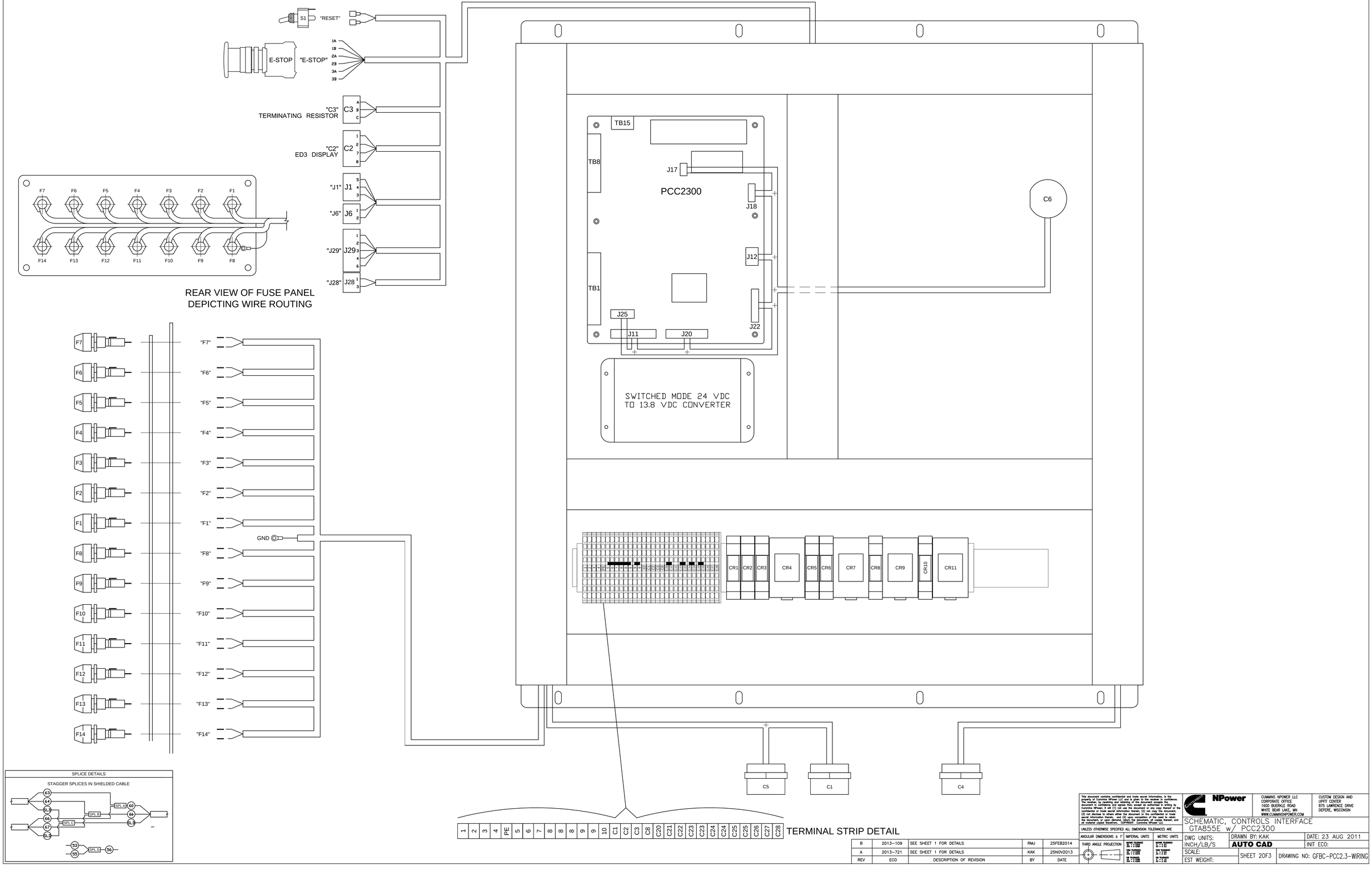
CUSTOM DESIGN AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE GTA855E w/ PCC2300

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 23 AUG 2011
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 10F3
DRAWING NO: GFBC-PCC2.3-WIRING



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B	2013-109	SEE SHEET 1 FOR DETAILS	RMJ	25FEB2014
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013
REV	ECO	DESCRIPTION OF REVISION	BY	DATE

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GTA855E w/ PCC2300

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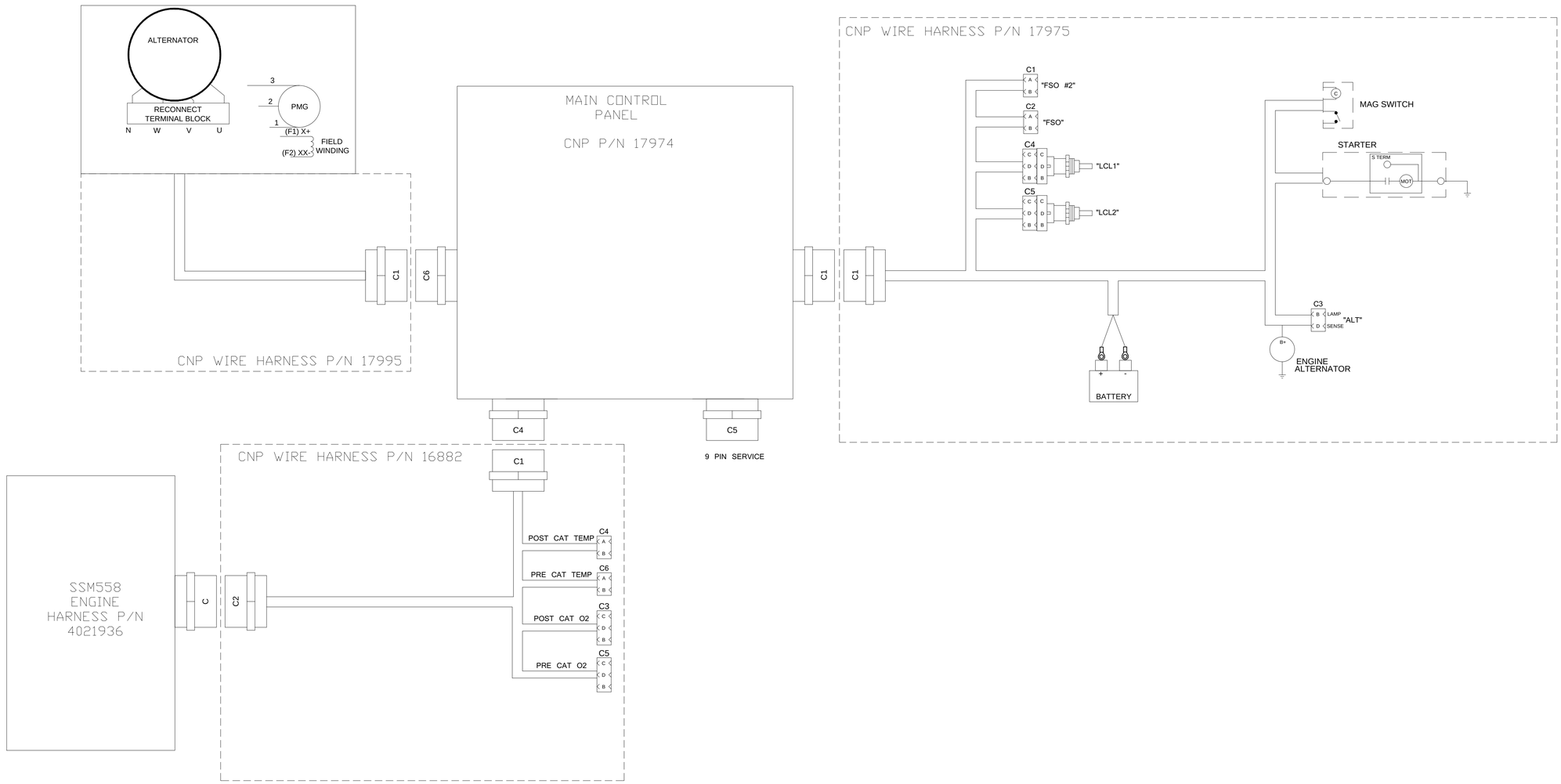
ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS	DWG UNITS: INCH/LB/S	DRAWN BY: KAK
THIRD ANGLE PROJECTION	.X ± 0.1 .XX ± 0.05 .XXX ± 0.010 .XXXX ± 0.0050	X ± 2.5 X.X ± 1.25 X.XX ± 0.25 X.XXX ± 0.127	AUTO CAD	DATE: 23 AUG 2011
			SCALE:	INIT ECO:
			EST WEIGHT:	SHEET 20F3

DRAWING NO: GFBC-PCC2.3-WIRING



REV	ECO	DESCRIPTION OF REVISION	BY	DATE
B	2013-109	SEE SHEET 1 FOR DETAILS	RMJ	25FEB2014
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	DECIMAL TOLERANCES .X ± 0.100 .XX ± 0.010 .XXX ± 0.005 FRACTIONAL TOLERANCES ± 1/64	DECIMAL TOLERANCES X ± 2.5 XX ± 0.25 FRACTIONAL TOLERANCES ± 0.4

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875 LAWRENCE DRIVE
DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE
GTA855E W/ PCC2300

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 23 AUG 2011	
	AUTO CAD		INIT ECO:
SCALE:	SHEET 3OF3	DRAWING NO: GFBC-PCC2.3-WIRING	
EST WEIGHT:			

TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	+24VDC SUPPLY
3	+24VDC SUPPLY
4	5A FUSED B+ FROM F5
5	-24VDC RETURN
6	-24VDC RETURN
7	-24VDC RETURN
8	-24VDC RETURN
9	20A FUSED B+ FROM F6
10	SYSTEM WAKEUP
C1	FUEL SHUTOFF VALVE CONTROL CONTACT
C2	FUEL SHUTOFF VALVE CONTROL CONTACT
C3	ECM SWITCH COMMON
C8	IDLE/RATED INPUT
C20	ECM KEYSWITCH
C21	+24VDC ED3 DISPLAY POWER (SWITCHED)
C22	ED3 DISPLAY GROUND
C23	J1939 DATA LINK+
C24	J1939 DATA LINK-
C25	J1939 DATA LINK SHIELD
C26	5A FUSED B+ FROM F5
C27	CUSTOMER NORMAL SHUTDOWN (FSO)
C28	CUSTOMER IGNITION SHUTDOWN (FSO AND SPARK)

CR1 = EGO PRE CAT POWER UP RELAY LSD
CR2 = FSO CONTROL RELAY
CR3 = EGO POST CAT POWER UP RELAY
CR4 = BATTERY CONSERVATION RELAY
CR5 = ENGINE SHUTDOWN RELAY
CR6 = ENGINE WARNING RELAY
CR7 = CUSTOMER NORMAL SHUTDOWN RELAY
CR8 = CD200 FSO SHUTOFF RELAY
CR9 = CUSTOMER E-SHUTDOWN RELAY
CR10 = START RELAY
CR11 = PCC FSO RELAY.
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F12 = PCC B+ 4A
F13 = PCC B+ 4A
F14 = PCC B+ 4A

S1 = CONTROLLER RESET

LEGEND

= RELAY COIL

= RELAY CONTACT

= TERMINAL BLOCK

ALTERNATOR
RECONNECT TERMINAL BLOCK
PMG
FIELD WINDING
MAIN BREAKER MCB_1
TO CUSTOMER LOAD
ALTERNATOR HARNESS
ALT. GROUND BOLT
MAIN CONTROL PANEL (SEE SHEET 2 FOR LAYOUT)
E-STOP
PCC3300
STARTER
PCC FSO
F9 (10A)
F8 (10A)
HMI 320
HMI 114
E-STOP
C5 9 PIN ECM DIAGNOSTIC
C2 ED3 DISPLAY
120 OHM
J26
AUX 103 (AVR)
ECM RESET
24VDC TO 13.8VDC CONVERTOR
ENGINE INTERFACE HARNESS (C1 MATES UP TO 47 PIN ON ENGINE HARNESS CONNECTOR)
ECM
PRE CATALYST O2
POST CATALYST O2
PRE CATALYST TEMP
POST CATALYST TEMP
POWER AND SENSOR HARNESS
"FSO #2"
"FSO"
"ALT"
"LCL2"
"LCL1"
ENGINE ALTERNATOR
BATTERY

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021936-02 FOR ENGINE SIDE WIRING AND INTERFACE

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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

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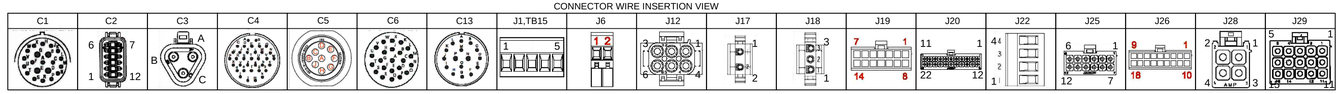
CUSTOM DESIGN AND UPFIT CENTER
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

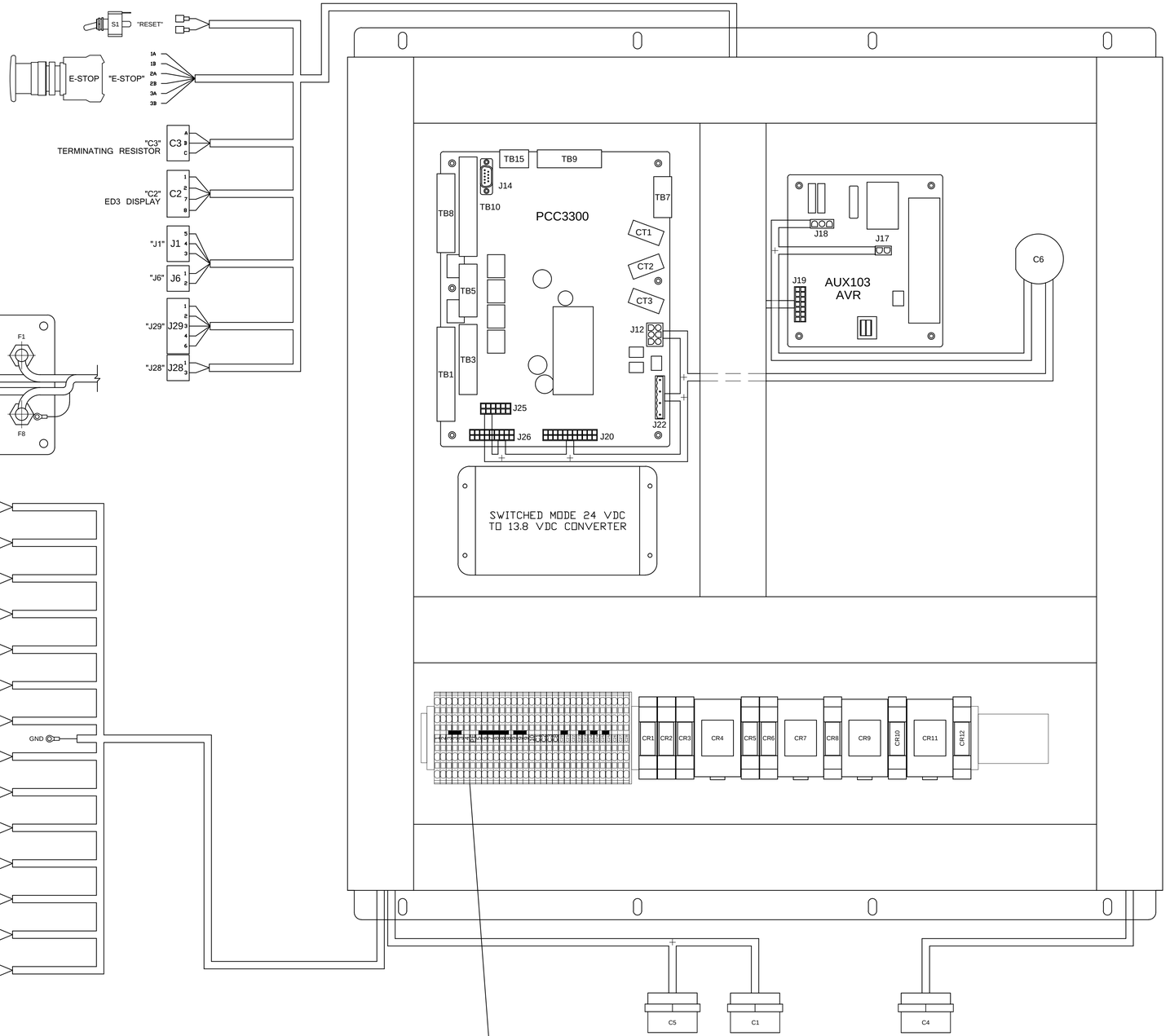
SCHEMATIC, CONTROLS INTERFACE
GTA855E w/ PCC3300

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 23 AUG 2011
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 1OF3
DRAWING NO: GFBC-PCC3.3-WIRING

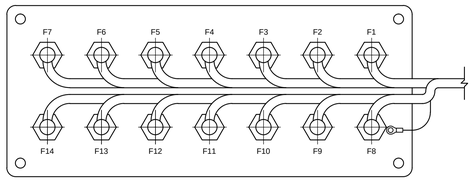
REV	ECO	DESCRIPTION OF REVISION	BY	DATE
B	2014-109	CORRECTED PINOUTS BETWEEN C1 & C2.	RMJ	25FEB2014
A	2013-721	ADDED JUMPER BETWEEN TERMINALS C3 & C8. FIXED O2 WIRING. ADDED SHEET 3.	KAK	25NOV2013

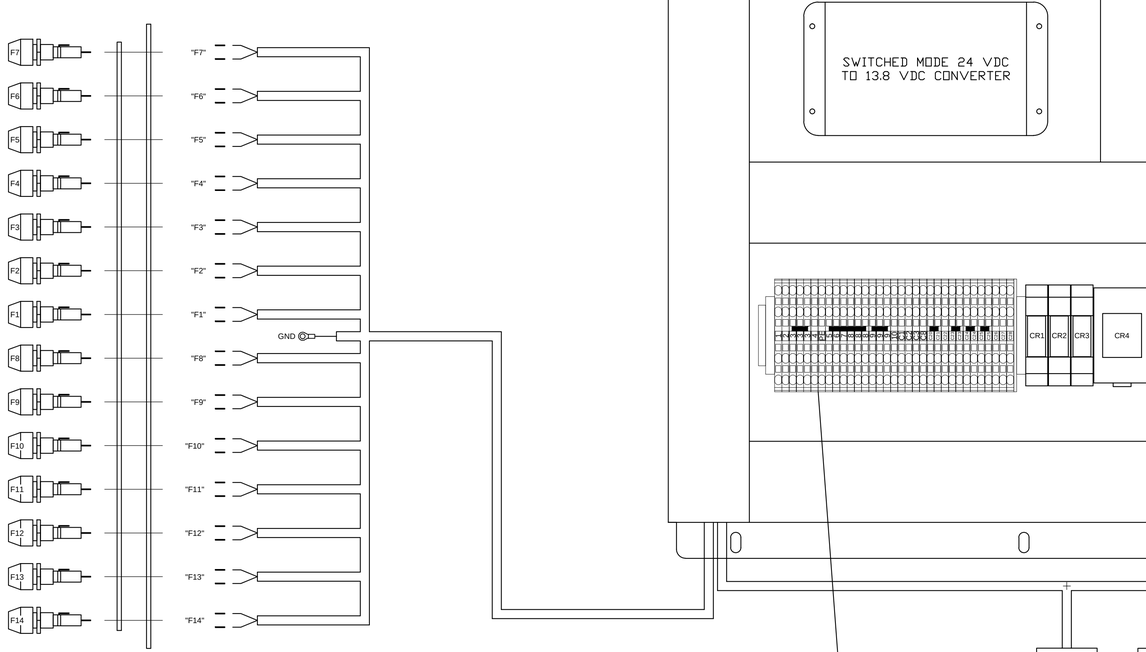
CONNECTOR WIRE INSERTION VIEW





REAR VIEW OF FUSE PANEL
DEPICTING WIRE ROUTING

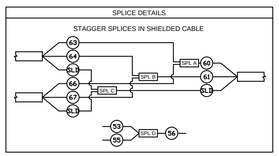




TERMINAL STRIP DETAIL

SPLICE DETAILS

STAGGER SPLICES IN SHIELDED CABLE



REV	ECO	DESCRIPTION OF REVISION	BY	DATE
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A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS

METRIC UNITS

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DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE GTA855E w/ PCC3300

DWG UNITS: INCH/LB/S

DRAWN BY: KAK

DATE: 23 AUG 2011

AUTO CAD

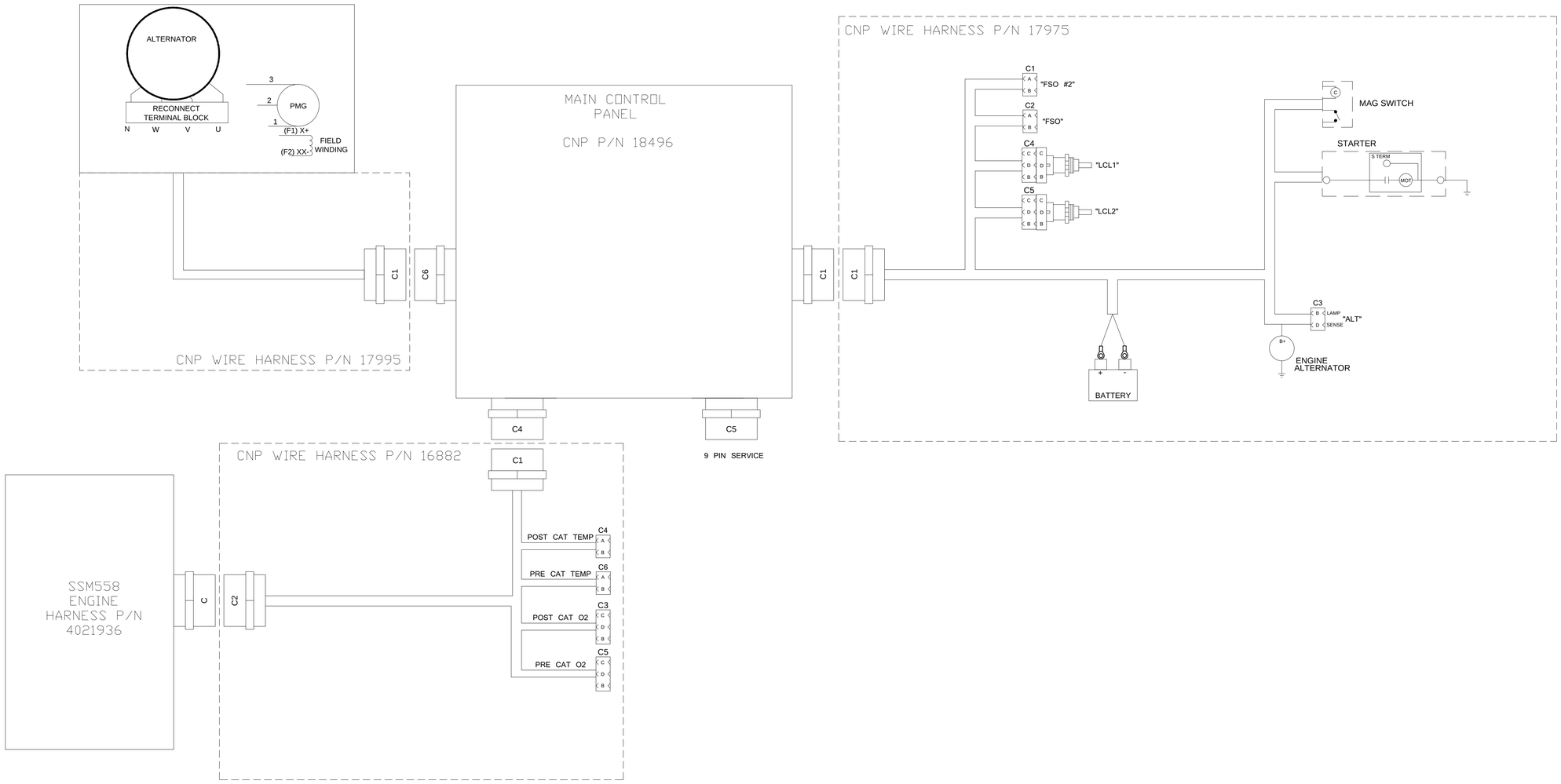
INIT ECO:

SCALE:

EST WEIGHT:

SHEET 20F3

DRAWING NO: GFBC-PCC3.3-WIRING



REV	ECO	DESCRIPTION OF REVISION	BY	DATE
B	2013-109	SEE SHEET 1 FOR DETAILS	RMJ	25FEB2014
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	.X ± 0.100 .XX ± 0.030 .XXX ± 0.010	X ± 2.5 X.X ± 0.8 X.XX ± 0.25

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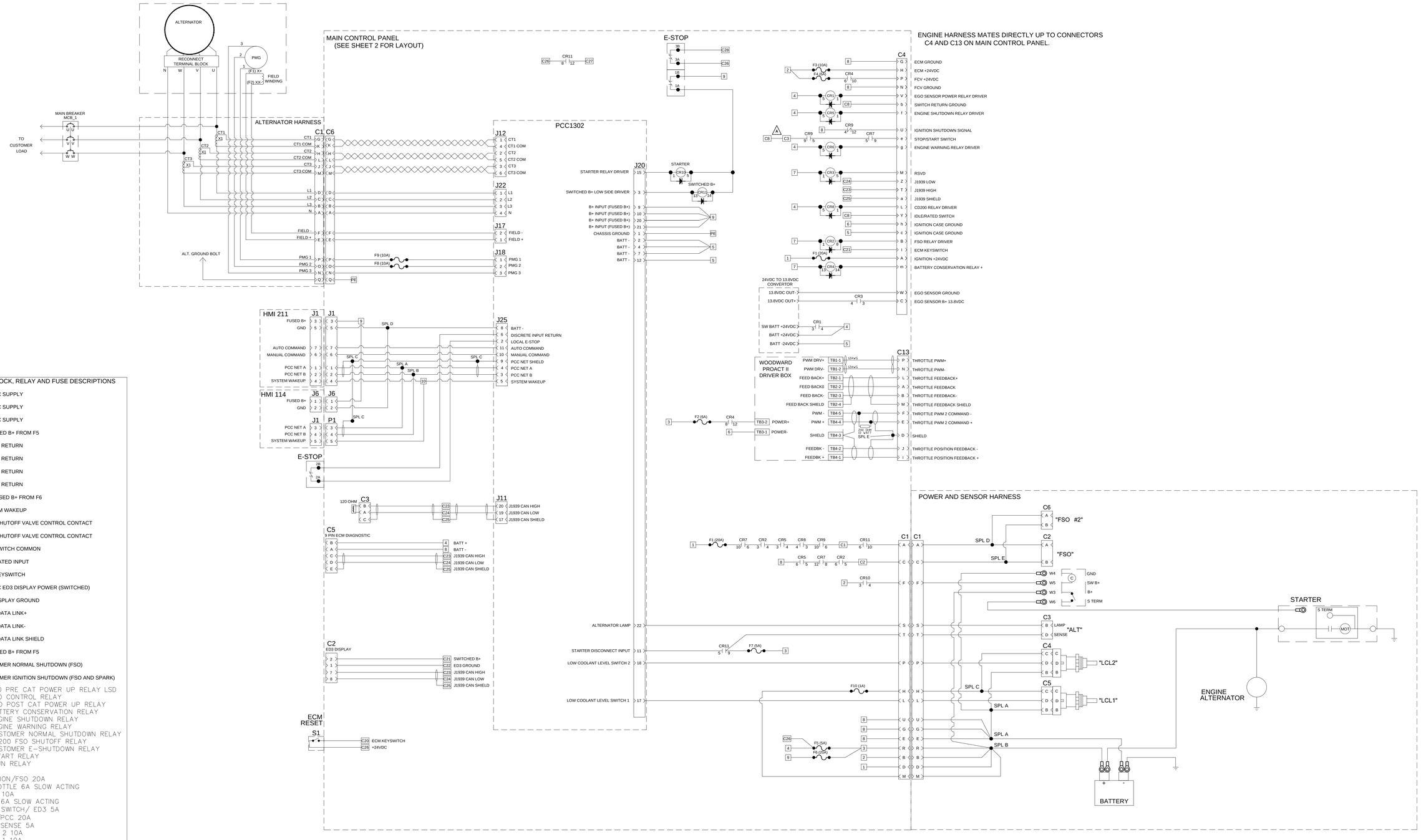
SCHEMATIC, CONTROLS INTERFACE
GTA855E W/ PCC3.300

DWG UNITS:	DRAWN BY: KAK	DATE: 23 AUG 2011
INCH/LB/S	AUTO CAD	INIT ECO:
SCALE:	SHEET 30F3	DRAWING NO: GFBC-PCC3.3-WIRING
EST WEIGHT:		



TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	+24VDC SUPPLY
3	+24VDC SUPPLY
4	5A FUSED B+ FROM F5
5	-24VDC RETURN
6	-24VDC RETURN
7	-24VDC RETURN
8	-24VDC RETURN
9	20A FUSED B+ FROM F6
10	SYSTEM WAKEUP
C1	FUEL SHUTOFF VALVE CONTROL CONTACT
C2	FUEL SHUTOFF VALVE CONTROL CONTACT
C3	ECM SWITCH COMMON
C8	IDLE/RATED INPUT
C20	ECM KEYSWITCH
C21	+24VDC ED3 DISPLAY POWER (SWITCHED)
C22	ED3 DISPLAY GROUND
C23	J1939 DATA LINK+
C24	J1939 DATA LINK-
C25	J1939 DATA LINK SHIELD
C26	5A FUSED B+ FROM F5
C27	CUSTOMER NORMAL SHUTDOWN (FSO)
C28	CUSTOMER IGNITION SHUTDOWN (FSO AND SPARK)

CR1 = EGO PRE CAT POWER UP RELAY LSD
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CR9 = CUSTOMER E-SHUTDOWN RELAY
CR10 = START RELAY
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F6 = HMI/PCC 20A
F7 = ALT SENSE 5A
F8 = PMG 2 10A
F9 = PMG 1 10A
F10 = LOW COOLANT LEVEL 1A

S1 = CONTROLLER RESET

LEGEND

CR# = RELAY COIL

CR# = RELAY CONTACT

10 = TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021667-01 FOR ENGINE SIDE WIRING AND INTERFACE

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	ADDED JUMPER BETWEEN TERMINALS C3 & C8. REMOVED C7. ADDED SHEET 3.	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS

THIRD ANGLE PROJECTION

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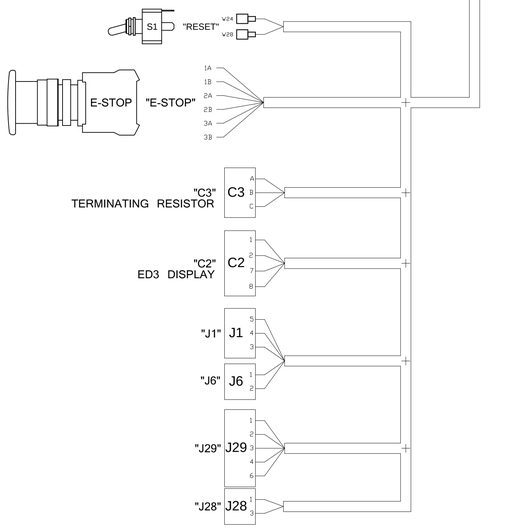
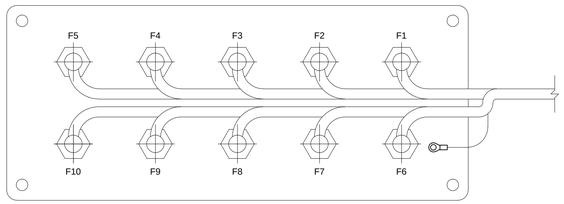
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

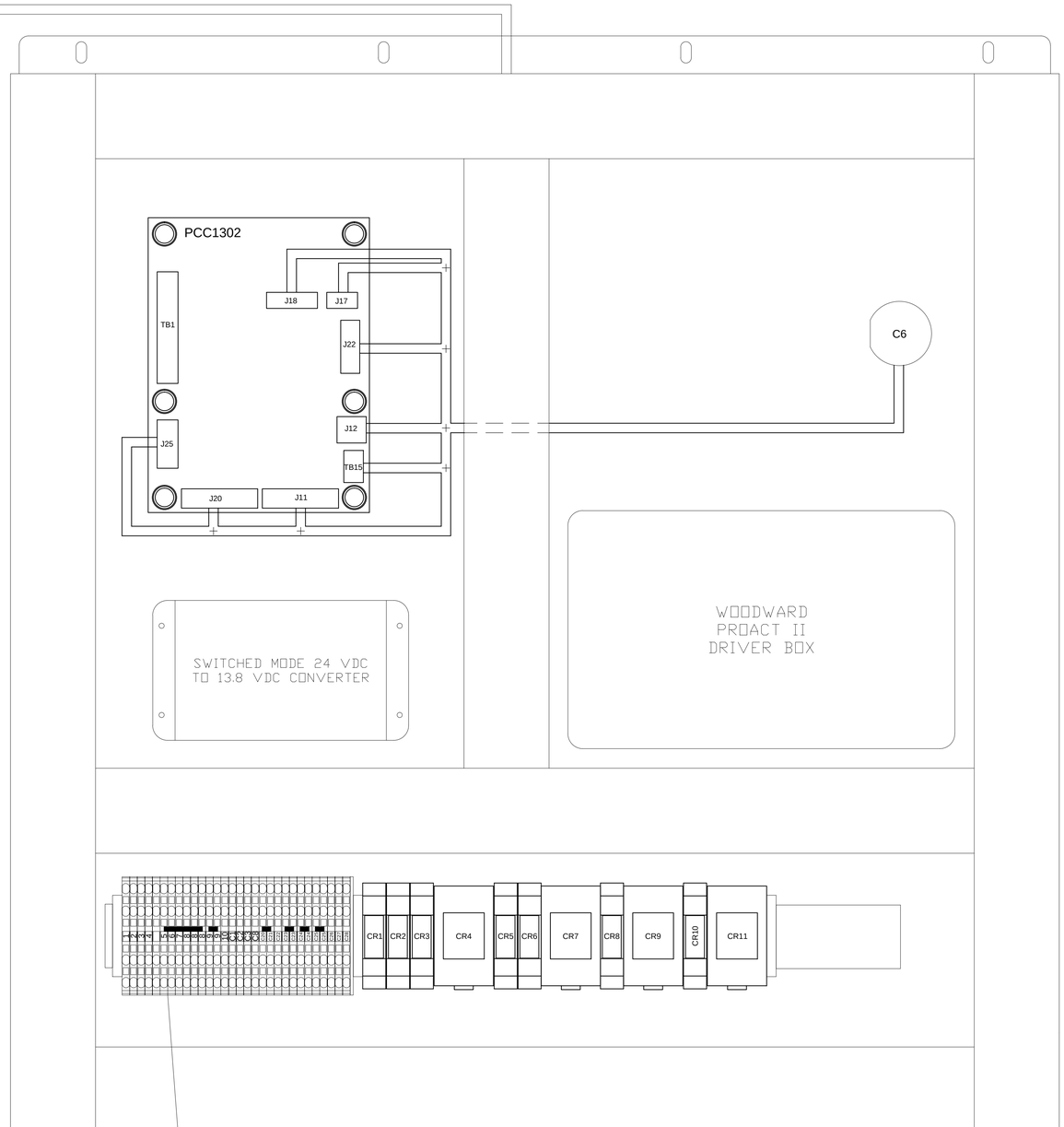
SCHEMATIC, CONTROLS INTERFACE
KTA19SLB w/ PCC1302

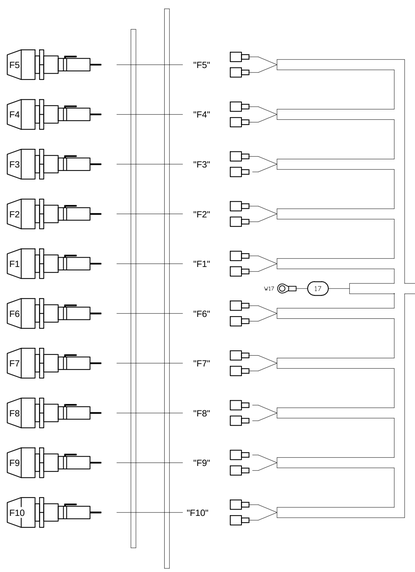
DWG UNITS: INCH/LB/S | DRAWN BY: KAK | DATE: 2 SEPT 2011
AUTO CAD | INIT ECO:
SCALE: | SHEET 10F3 | DRAWING NO: GFEB-PCC1.3-WIRING
EST WEIGHT:

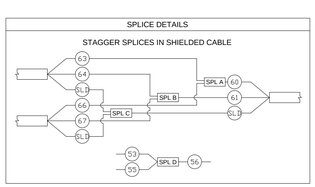




REAR VIEW OF FUSE PANEL
DEPICTING WIRE ROUTING







1	2	3	4	PE	5	6	7	8	8	8	9	9	10	C1	C2	C3	C8	C20	C21	C22	C23	C23	C24	C24	C25	C25	C26	C27	C28

TERMINAL STRIP DETAIL

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
DECIMAL PLACES: X = ± .03	DECIMAL PLACES: X = ± .8
.XX = ± .010	.XX = ± .25
.XXX = ± .005	.XXX = ± .127
FRACTIONS: X = ± 1/64	FRACTIONS: X = ± .4

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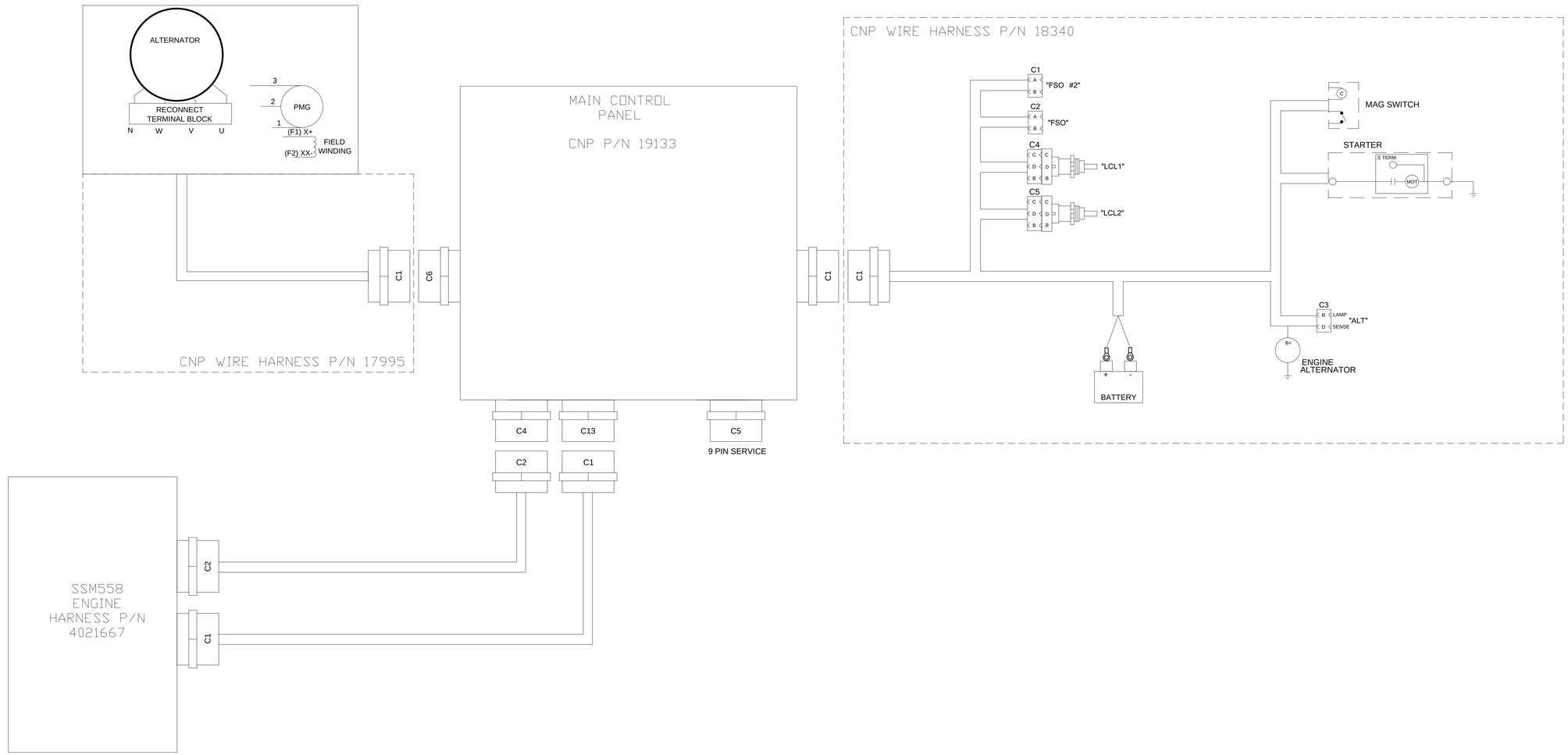
DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE
KTA19SLB w/ PCC1302

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 2 SEPT 2011
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 20F3
DRAWING NO: GFEB-PCC1.3-WIRING



REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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SCHEMATIC, CONTROLS INTERFACE
KTA19SLB W/ PCC1302

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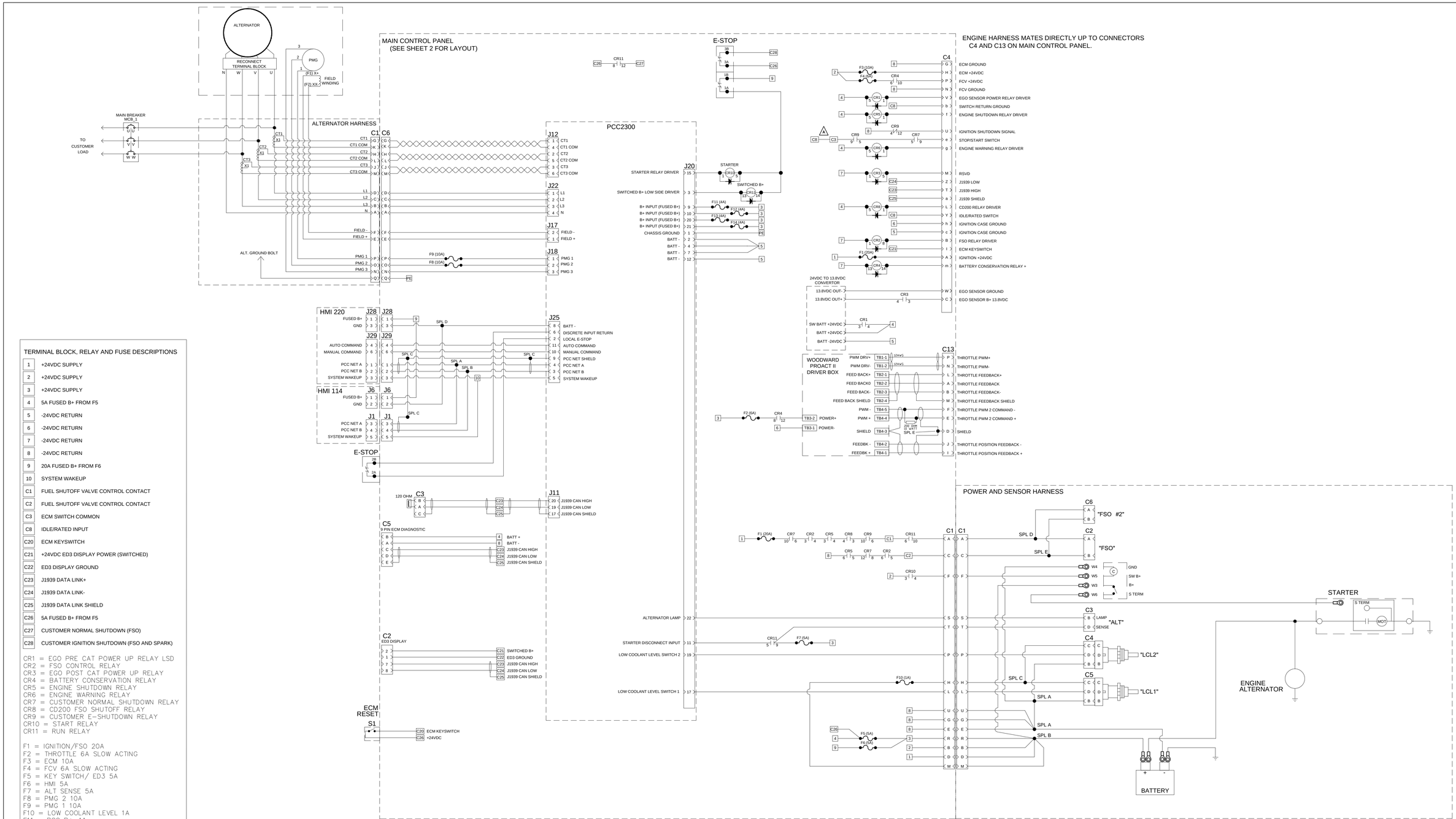
ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

DWG UNITS: INCH/LB/S | DRAWN BY: KAK | DATE: 02 SEPT 2011
AUTO CAD | INIT ECO:
SCALE: | SHEET 30F3 | DRAWING NO: GFEB-PCC1.3-WIRING
EST WEIGHT:



TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	+24VDC SUPPLY
3	+24VDC SUPPLY
4	5A FUSED B+ FROM F5
5	-24VDC RETURN
6	-24VDC RETURN
7	-24VDC RETURN
8	-24VDC RETURN
9	20A FUSED B+ FROM F6
10	SYSTEM WAKEUP
C1	FUEL SHUTOFF VALVE CONTROL CONTACT
C2	FUEL SHUTOFF VALVE CONTROL CONTACT
C3	ECM SWITCH COMMON
C8	IDLE/RATED INPUT
C20	ECM KEYSWITCH
C21	+24VDC ED3 DISPLAY POWER (SWITCHED)
C22	ED3 DISPLAY GROUND
C23	J1939 DATA LINK+
C24	J1939 DATA LINK-
C25	J1939 DATA LINK SHIELD
C26	5A FUSED B+ FROM F5
C27	CUSTOMER NORMAL SHUTDOWN (FSO)
C28	CUSTOMER IGNITION SHUTDOWN (FSO AND SPARK)

CR1 = EGO PRE CAT POWER UP RELAY LSD
CR2 = FSO CONTROL RELAY
CR3 = EGO POST CAT POWER UP RELAY
CR4 = BATTERY CONSERVATION RELAY
CR5 = ENGINE SHUTDOWN RELAY
CR6 = ENGINE WARNING RELAY
CR7 = CUSTOMER NORMAL SHUTDOWN RELAY
CR8 = CD200 FSO SHUTOFF RELAY
CR9 = CUSTOMER E-SHUTDOWN RELAY
CR10 = START RELAY
CR11 = RUN RELAY

F1 = IGNITION/FSO 20A
F2 = THROTTLE 6A SLOW ACTING
F3 = ECM 10A
F4 = FCV 6A SLOW ACTING
F5 = KEY SWITCH/ ED3 5A
F6 = HMI 5A
F7 = ALT SENSE 5A
F8 = PMG 2 10A
F9 = PMG 1 10A
F10 = LOW COOLANT LEVEL 1A
F11 = PCC B+ 4A
F12 = PCC B+ 4A
F13 = PCC B+ 4A
F14 = PCC B+ 4A

S1 = CONTROLLER RESET

LEGEND

CR# = RELAY COIL

CR# = RELAY CONTACT

10 = TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021667-01 FOR ENGINE SIDE WIRING AND INTERFACE

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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	REMOVED C7. ADDED SHEET 3. ADDED JUMPER BETWEEN TERMINALS C3 & C8.	KAK	25NOV2013

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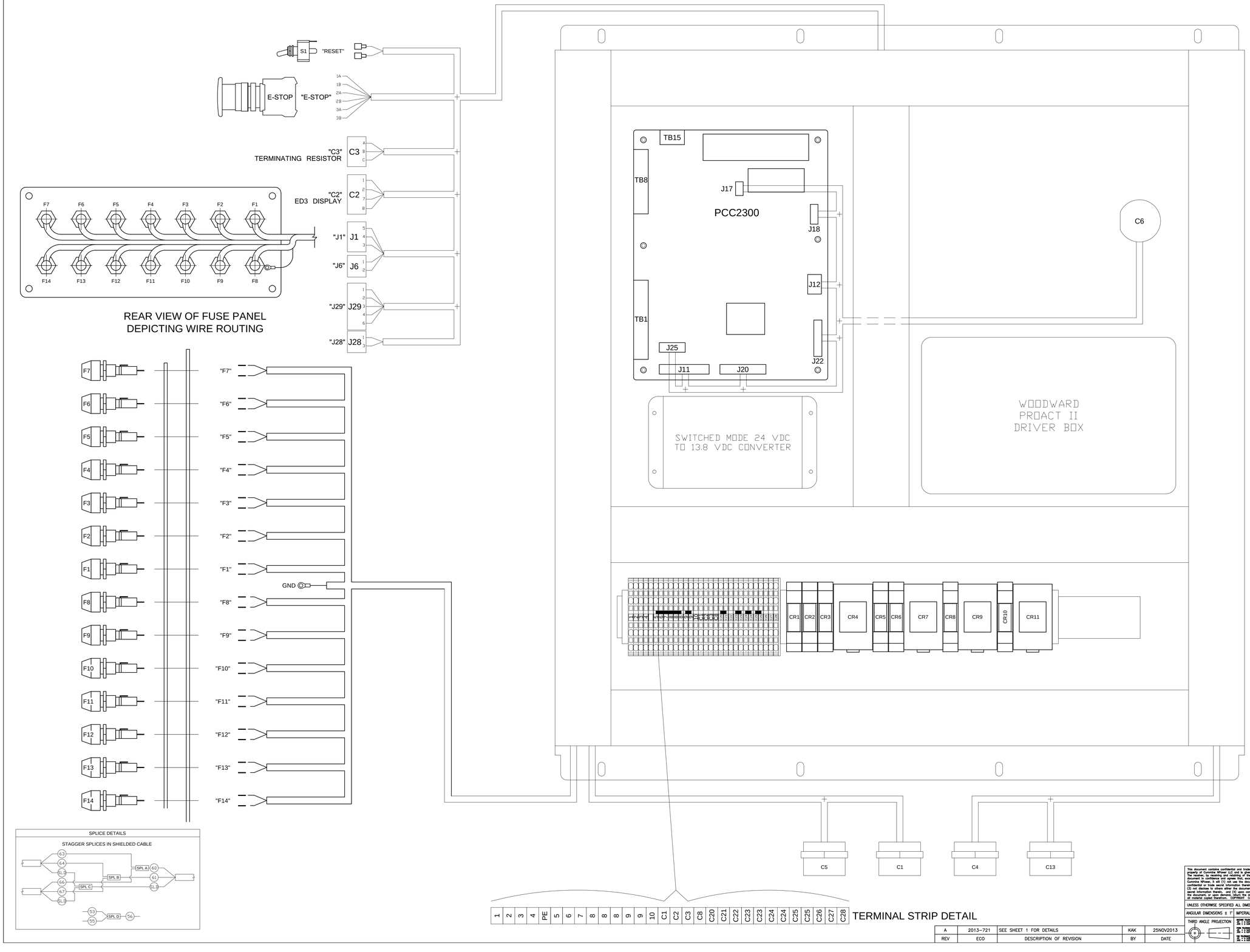
SCHEMATIC, CONTROLS INTERFACE
KTA19SLB w/ PCC2300

DWG UNITS: INCH/LB/S
AUTO CAD
DRAWN BY: KAK
DATE: 23 AUG 2011
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 10F3
DRAWING NO: GFEB-PCC2.3-WIRING



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THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
.X ± 0.1	X ± 2.5
.XX ± 0.05	X.X ± 1.25
.XXX ± 0.010	X.XX ± 0.25
.XXXX ± 0.0050	X.XXX ± 0.127

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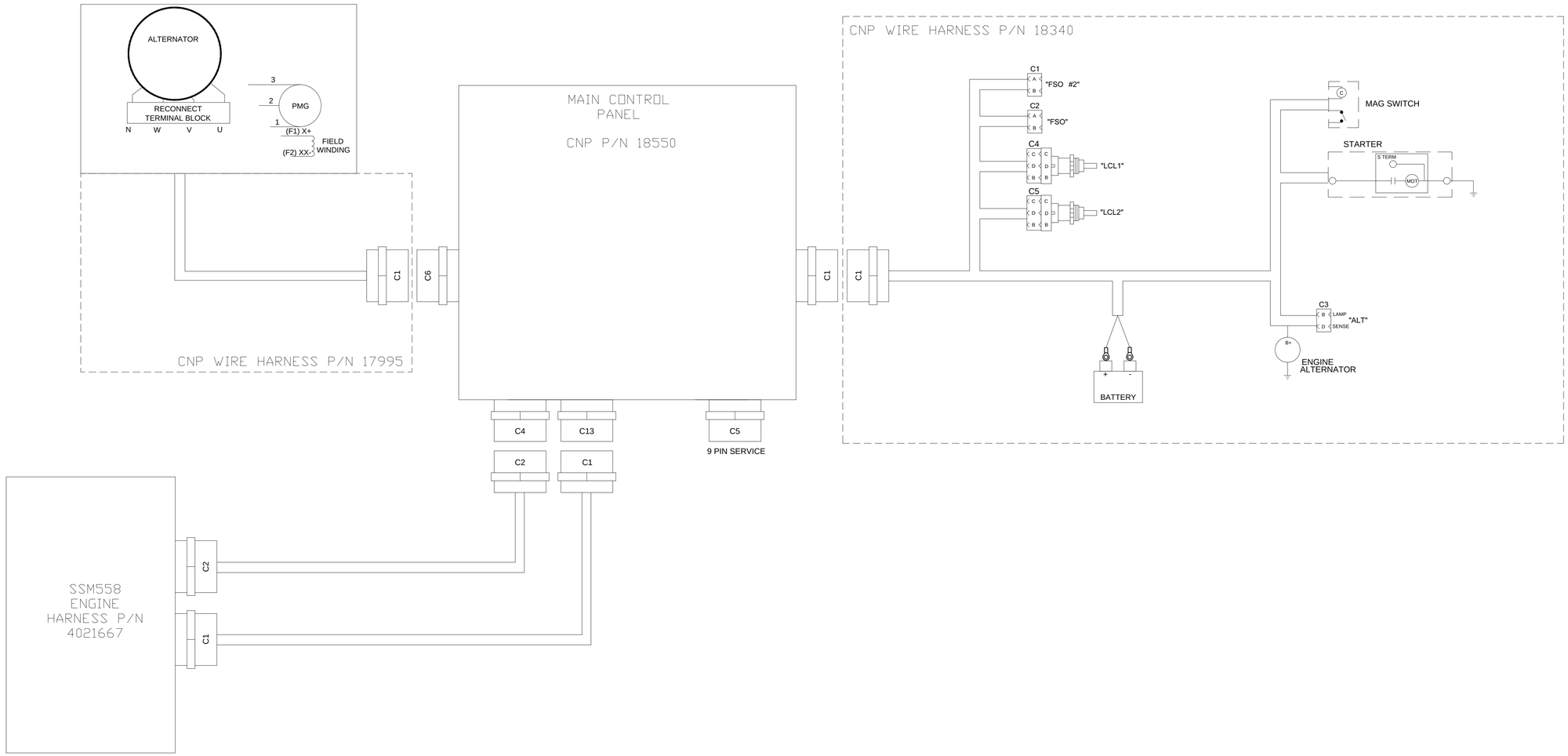
SCHEMATIC, CONTROLS INTERFACE
KTA19SLB w/ PCC2300

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 23 AUG 2011
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 2OF3
DRAWING NO: GFEB-PCC2.3-WIRING



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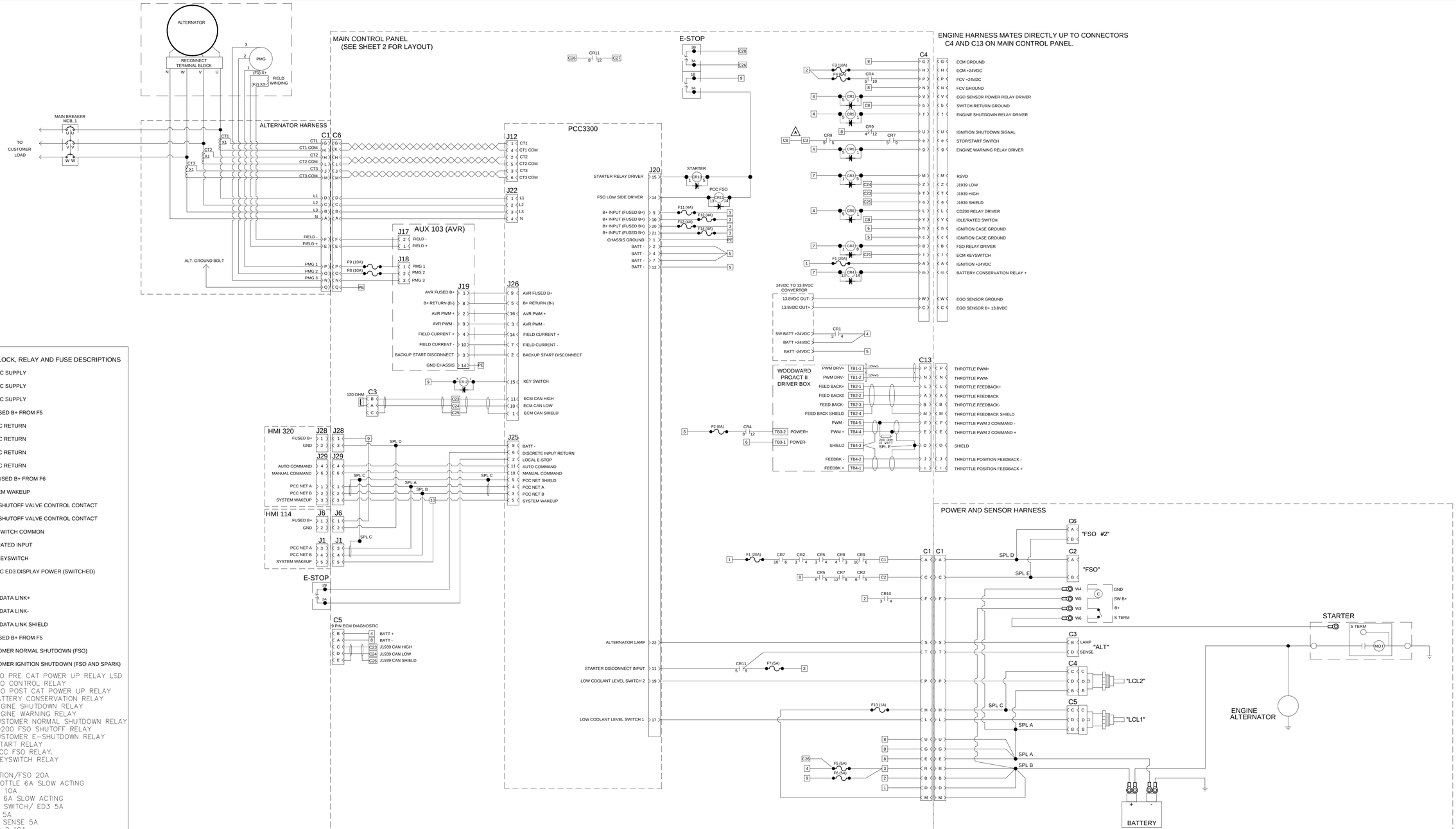
ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS DECIMAL PLACES XX = ± .030 XXX = ± .015 FRACTIONS XX = ± 1/64 DECIMAL PLACES XXX = ± .010 FRACTIONS XX = ± 1/64	METRIC UNITS DECIMAL PLACES X = ± 1.0 XX = ± 0.5 FRACTIONS X = ± 1.0 DECIMAL PLACES XX = ± 0.5 FRACTIONS X = ± 1.0
THIRD ANGLE PROJECTION		
DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 23 AUG 2011
AUTO CAD		INIT ECO:
SCALE:	SHEET 30F3	DRAWING NO: GFEB-PCC2.3-WIRING
EST WEIGHT:		

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013



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F13 = PCC B+ 4A
F14 = PCC B+ 4A

S1 = CONTROLLER RESET

LEGEND

- CR# = RELAY COIL
- CR# = RELAY CONTACT
- 10 = TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE
2) SEE CUMMINS DRAWING #4021667-01 FOR ENGINE SIDE WIRING AND INTERFACE

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ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

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A	2013-721	REMOVED C7. ADDED SHEET 3. ADDED JUMPER BETWEEN TERMINALS C3 & C8.	KAK	25NOV2013

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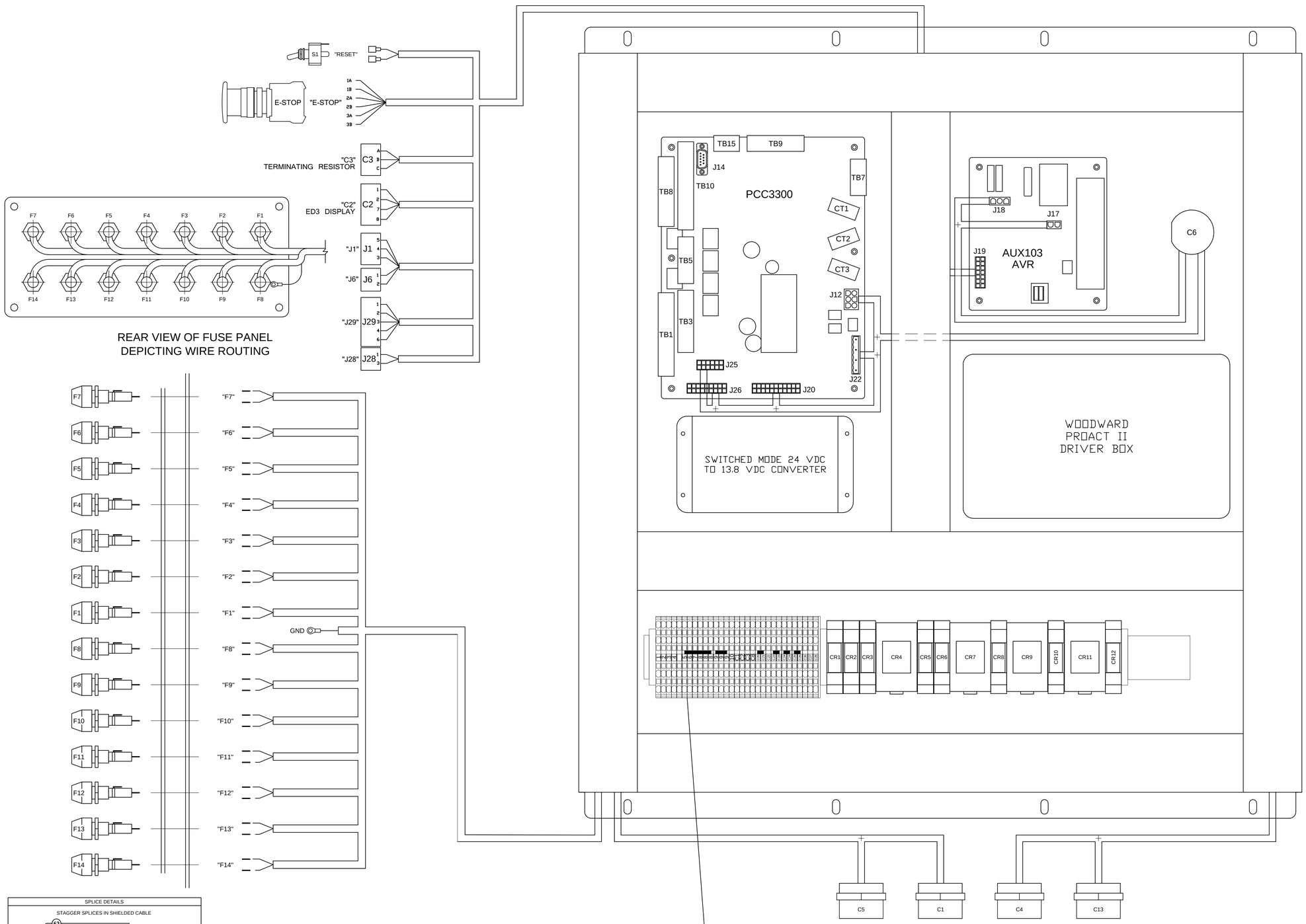
KTA19SLB w/ PCC3300

DWG UNITS: INCH/LB/S | DRAWN BY: KAK | DATE: 23 AUG 2011
AUTO CAD | INIT ECO:
SCALE: | EST WEIGHT: | SHEET 10F3 | DRAWING NO: GFEB-PCC3.3-WIRING



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IMPERIAL UNITS	METRIC UNITS
.X = ±.1 [mm]	X = ±2.5 [mm]
.XX = ±.05 [mm]	.X = ±1.3 [mm]
.XXX = ±.010 [mm]	.XX = ±0.25 [mm]
.XXXX = ±.0050 [mm]	.XXX = ±0.127 [mm]
.XXXXX = ±.0010 [mm]	.XXXX = ±0.0254 [mm]

THIRD ANGLE PROJECTION

REV	ECO	DESCRIPTION OF REVISION	BY	DATE
A	2013-721	SEE SHEET 1 FOR DETAILS	KAK	25NOV2013

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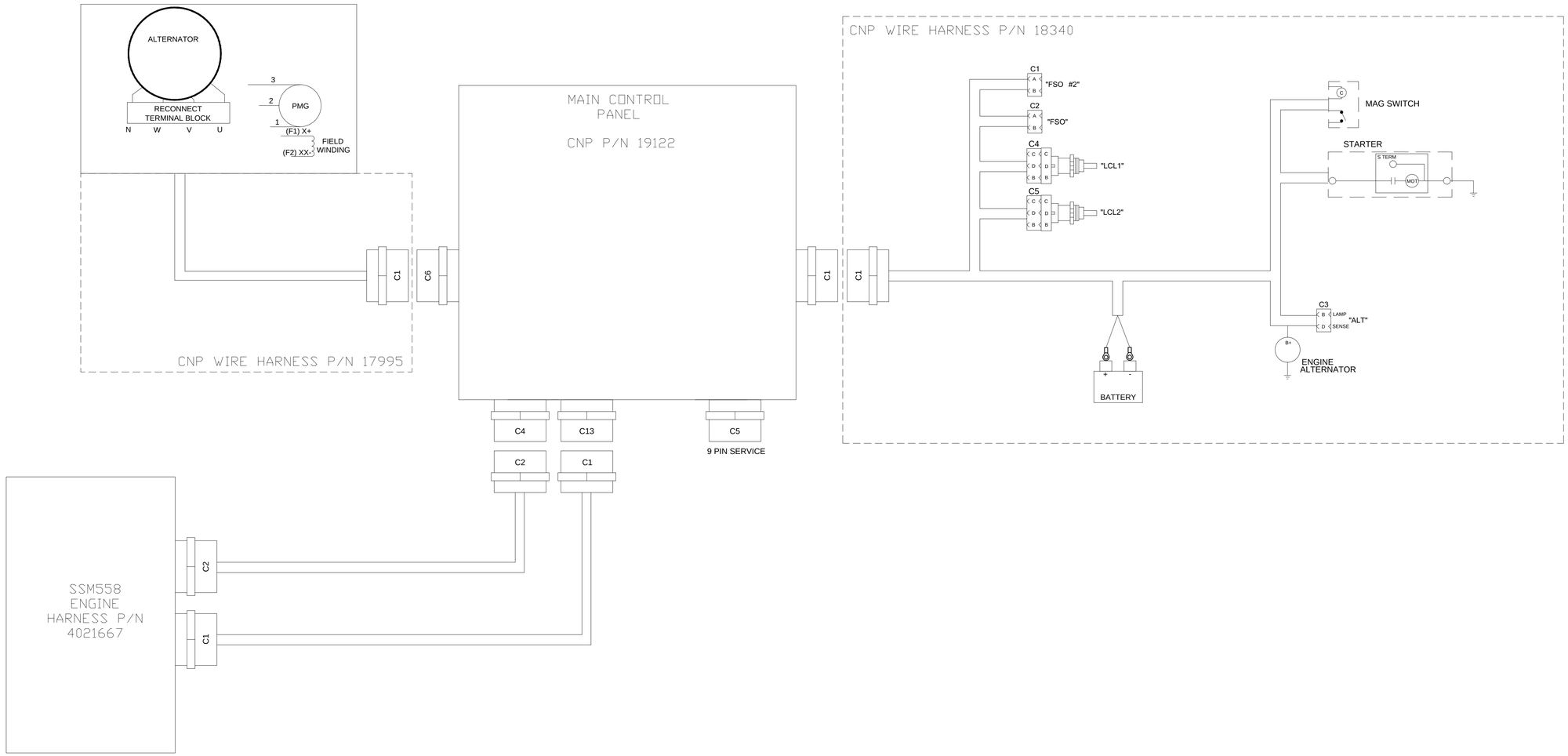
SCHEMATIC, CONTROLS INTERFACE
KTA19SLB w/ PCC3300

DWG UNITS: INCH/LB/S
AUTO CAD

DRAWN BY: KAK
DATE: 23 AUG 2011
INIT ECO:

SCALE:
EST WEIGHT:
SHEET 2OF3
DRAWING NO: GFEB-PCC3.3-WIRING



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ANGULAR DIMENSIONS ± 1°

THIRD ANGLE PROJECTION

IMPERIAL UNITS	METRIC UNITS
.XX ± .030 .XXX ± .005 .XXXX ± .0005 FRACTIONS ± 1/64	.X ± 0.5 .XX ± 0.13 .XXX ± 0.013

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SCHEMATIC, CONTROLS INTERFACE
KTA19SLB W/ PCC3300

DWG UNITS: INCH/LB/S

DRAWN BY: KAK

DATE: 23 AUG 2011

AUTO CAD

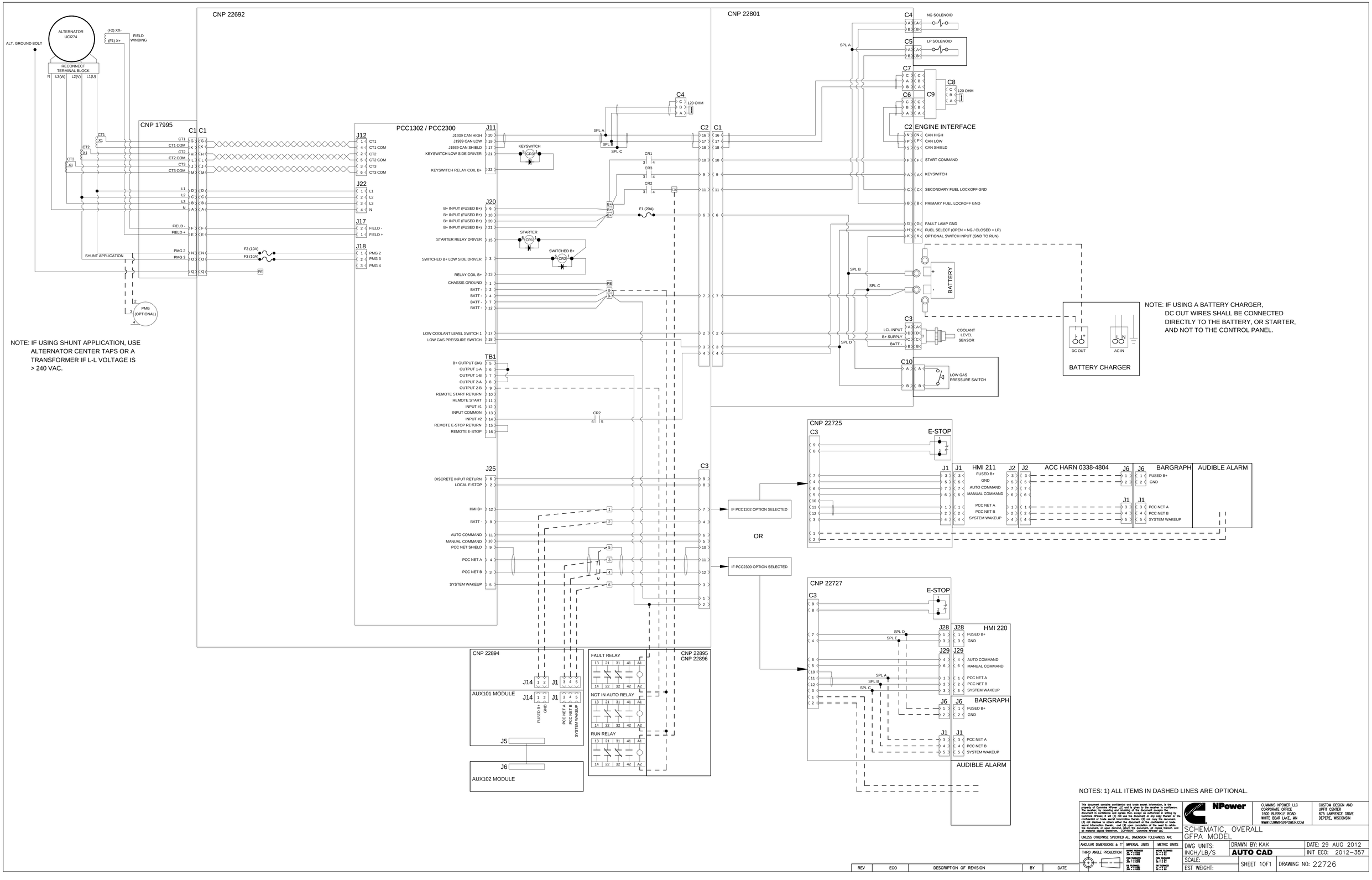
INIT ECO:

SCALE:

EST WEIGHT:

SHEET 30F3

DRAWING NO: GFEB-PCC3.3-WIRING


CNP 22692
CNP 22801
ALTERNATOR
UCI274
ALT. GROUND BOLT
(F2) XX-
(F1) X+
FIELD WINDING
RECONNECT TERMINAL BLOCK
N L3(W) L2(V) L1(U)
CNP 17995
SHUNT APPLICATION
PMG (OPTIONAL)
F2 (10A)
F3 (10A)
FE
PCC1302 / PCC2300
J11
J20
J25
TB1
J12
J22
J17
J18
KEYSWITCH
STARTER
SWITCHED B+
F1 (20A)
CR1
CR2
CR3
120 OHM
SPL A
SPL B
SPL C
SPL D
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
NG SOLENOID
LP SOLENOID
ENGINE INTERFACE
CAN HIGH
CAN LOW
CAN SHIELD
START COMMAND
KEYSWITCH
SECONDARY FUEL LOCKOFF GND
PRIMARY FUEL LOCKOFF GND
FAULT LAMP GND
FUEL SELECT (OPEN = NG / CLOSED = LP)
OPTIONAL SWITCH INPUT (GND TO RUN)
BATTERY
LCL INPUT
B+ SUPPLY
BATT -
COOLANT LEVEL SENSOR
LOW GAS PRESSURE SWITCH
DC OUT
AC IN
BATTERY CHARGER
NOTE: IF USING A BATTERY CHARGER, DC OUT WIRES SHALL BE CONNECTED DIRECTLY TO THE BATTERY, OR STARTER, AND NOT TO THE CONTROL PANEL.
NOTE: IF USING SHUNT APPLICATION, USE ALTERNATOR CENTER TAPS OR A TRANSFORMER IF L-L VOLTAGE IS > 240 VAC.
IF PCC1302 OPTION SELECTED
OR
IF PCC2300 OPTION SELECTED
CNP 22725
CNP 22727
E-STOP
HMI 211
HMI 220
ACC HARN 0338-4804
BARGRAPH
AUDIBLE ALARM
CNP 22894
AUX101 MODULE
AUX102 MODULE
CNP 22895
CNP 22896
FAULT RELAY
NOT IN AUTO RELAY
RUN RELAY
NOTES: 1) ALL ITEMS IN DASHED LINES ARE OPTIONAL.
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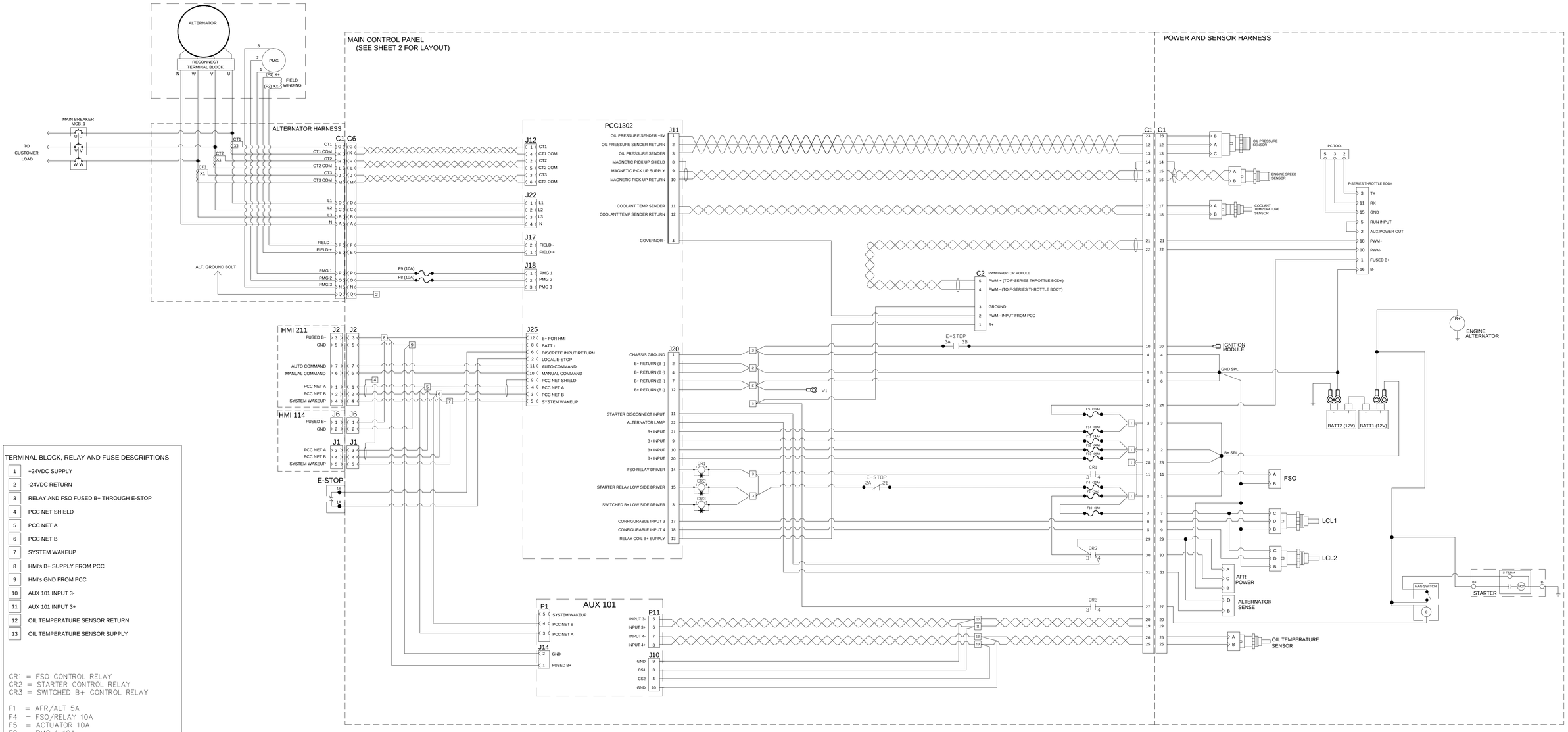
875 LAWRENCE DRIVE
DEPERE, WISCONSIN
SCHEMATIC, OVERALL
GFPA MODEL
DRAWN BY: KAK
DATE: 29 AUG 2012
AUTO CAD
INIT ECO: 2012-357
SHEET 10F1
DRAWING NO: 22726
REV
ECO
DESCRIPTION OF REVISION
BY
DATE



TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	-24VDC RETURN
3	RELAY AND FSO FUSED B+ THROUGH E-STOP
4	PCC NET SHIELD
5	PCC NET A
6	PCC NET B
7	SYSTEM WAKEUP
8	HMI's B+ SUPPLY FROM PCC
9	HMI's GND FROM PCC
10	AUX 101 INPUT 3-
11	AUX 101 INPUT 3+
12	OIL TEMPERATURE SENSOR RETURN
13	OIL TEMPERATURE SENSOR SUPPLY

CR1 = FSO CONTROL RELAY
CR2 = STARTER CONTROL RELAY
CR3 = SWITCHED B+ CONTROL RELAY

F1 = AFR/ALT 5A
F4 = FSO/RELAY 10A
F5 = ACTUATOR 10A
F8 = PMG 1 10A
F9 = PMG 2 10A
F10 = LOW COOLANT LEVEL 1A
F11 = PCC 4A
F12 = PCC 4A
F13 = PCC 4A
F14 = PCC 4A

LEGEND

= RELAY COIL

= RELAY CONTACT

= TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE

REV	ECO	DESCRIPTION OF REVISION	BY	DATE

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ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	.xx ± 0.01 .xxx ± 0.005 .xxxx ± 0.0005 fractions ± 1/64	.xx ± 0.25 .xxx ± 0.127 .xxxx ± 0.0127 fractions ± 0.5

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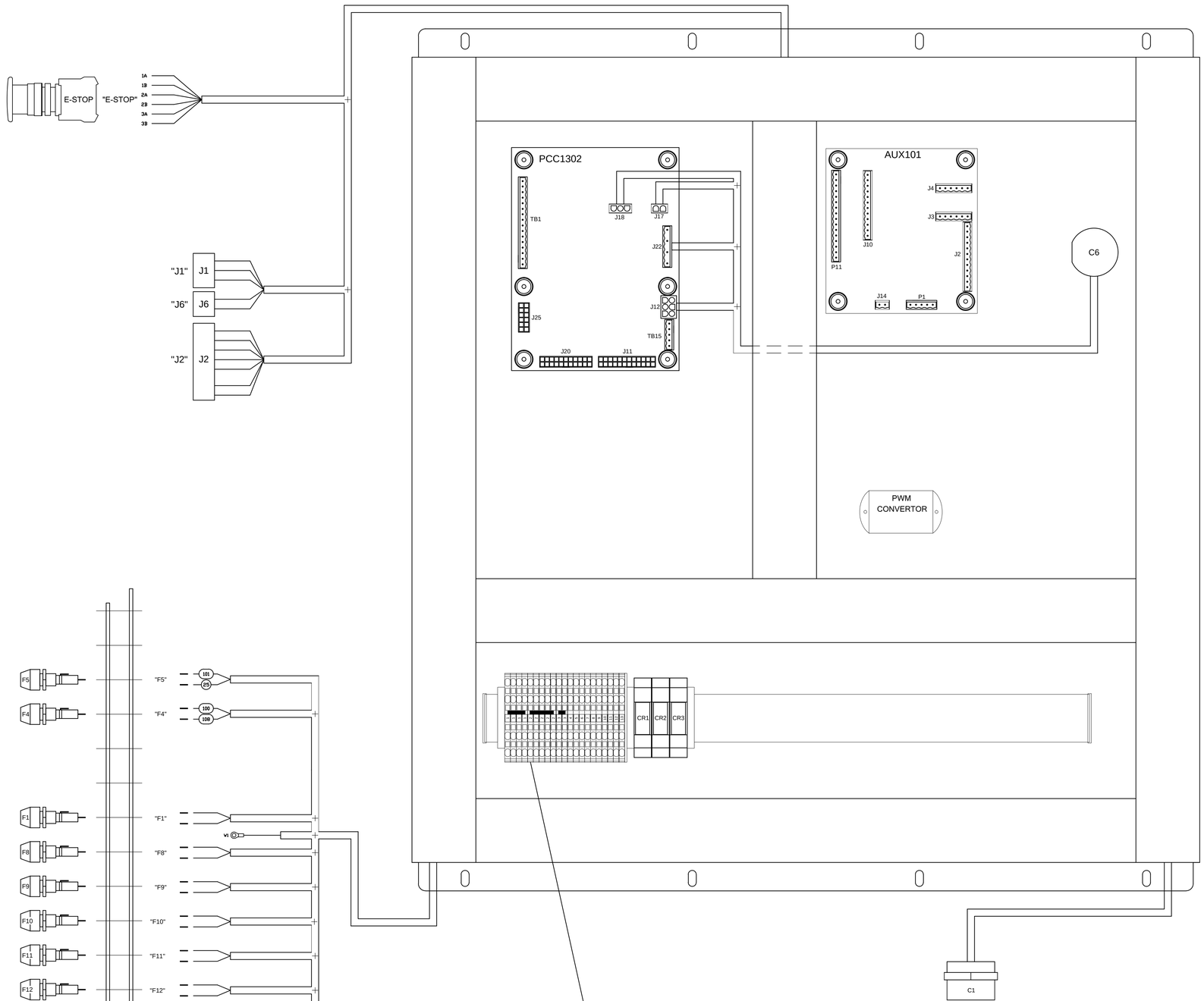
875 LAWRENCE DRIVE
DEPERE, WISCONSIN

SCHEMATIC, CONTROLS INTERFACE
HM ENG W/ PCC1302

DWG UNITS: INCH/LB/S	DRAWN BY: KAK	DATE: 31 MAY 2013
AUTO CAD		INIT ECO:
SCALE: EST WEIGHT:	SHEET 10F2	DRAWING NO: 25538



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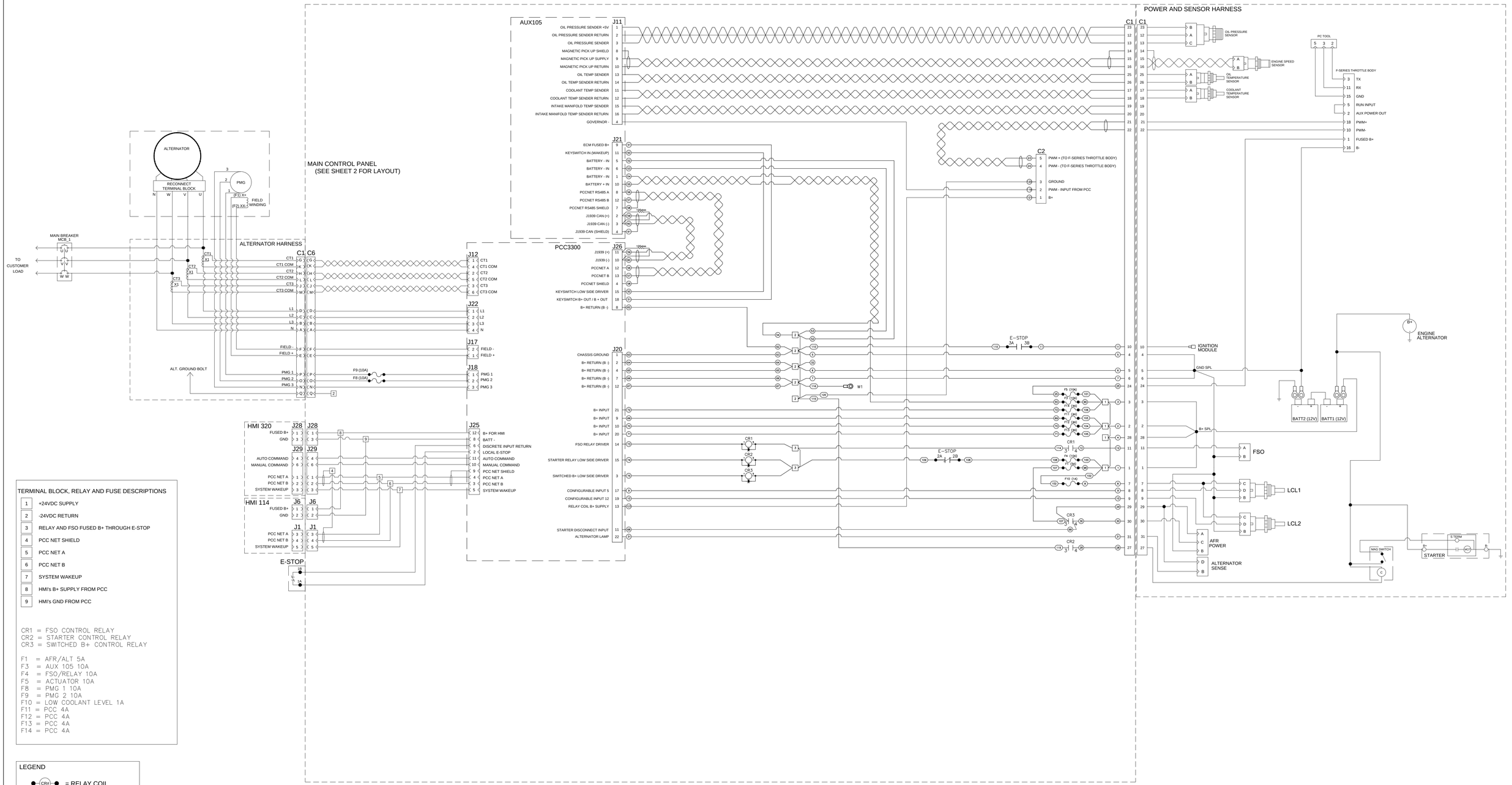
CONTROLS, INTERFACE BOX HM ENG W/ PCC1302

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	.X ± .1 [2.5] .XX ± .03 [.76] .XXX ± .010 [.254] ANGLES ± 1°	.X ± 2.5 .XX ± .13 .XXX ± .025 ANGLES ± 1°

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 31 MAY 2013
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 20F2
DRAWING NO: 25538



TERMINAL BLOCK, RELAY AND FUSE DESCRIPTIONS

1	+24VDC SUPPLY
2	-24VDC RETURN
3	RELAY AND FSO FUSED B+ THROUGH E-STOP
4	PCC NET SHIELD
5	PCC NET A
6	PCC NET B
7	SYSTEM WAKEUP
8	HMI's B+ SUPPLY FROM PCC
9	HMI's GND FROM PCC

CR1 = FSO CONTROL RELAY
CR2 = STARTER CONTROL RELAY
CR3 = SWITCHED B+ CONTROL RELAY

F1 = AFR/ALT 5A
F3 = AUX 105 10A
F4 = FSO/RELAY 10A
F5 = ACTUATOR 10A
F8 = PMG 1 10A
F9 = PMG 2 10A
F10 = LOW COOLANT LEVEL 1A
F11 = PCC 4A
F12 = PCC 4A
F13 = PCC 4A
F14 = PCC 4A

LEGEND

= RELAY COIL
= RELAY CONTACT
= TERMINAL BLOCK

REFERENCE: 1) SEE CPG DRAWING #0630-3440 FOR PCC SCHEMATICS AND INTERFACE

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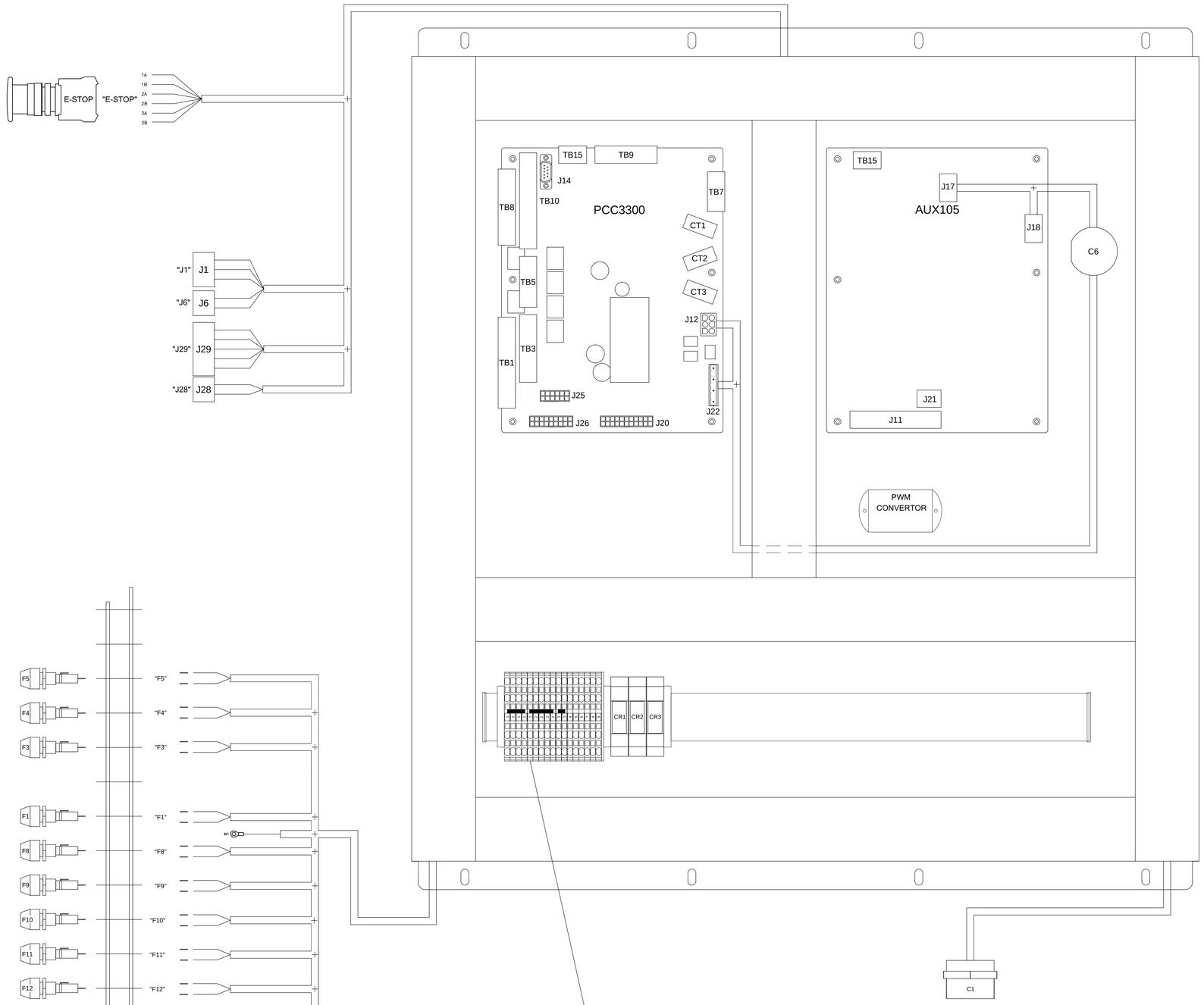
SCHEMATIC, CONTROLS INTERFACE HM ENG W/ PCC3300

UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE
ANGULAR DIMENSIONS ± 1° | IMPERIAL UNITS | METRIC UNITS
THIRD ANGLE PROJECTION

DWG UNITS: INCH/LB/S
DRAWN BY: KAK
DATE: 31 MAY 2013
AUTO CAD
INIT ECO:
SCALE:
EST WEIGHT:
SHEET 10F2
DRAWING NO: 25539

REV	ECO	DESCRIPTION OF REVISION	BY	DATE



TERMINAL STRIP DETAIL

REV	ECO	DESCRIPTION OF REVISION	BY	DATE

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UNLESS OTHERWISE SPECIFIED ALL DIMENSION TOLERANCES ARE

ANGULAR DIMENSIONS ± 1°	IMPERIAL UNITS	METRIC UNITS
THIRD ANGLE PROJECTION	.xx ± .030 in .xxx ± .010 in .xxxx ± .005 in fractions ± 1/64 in	.x ± 1 mm .xx ± 0.25 mm .xxx ± 0.13 mm fractions ± 0.5 mm

NPower

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EST WEIGHT:		

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